PAGE'S WEEKLY.—January 12, 1906. Thin Paper Copy for Circulation Abroad.

No. 70. Vol. 8.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
JANUARY 12, 1906.

UNIVER
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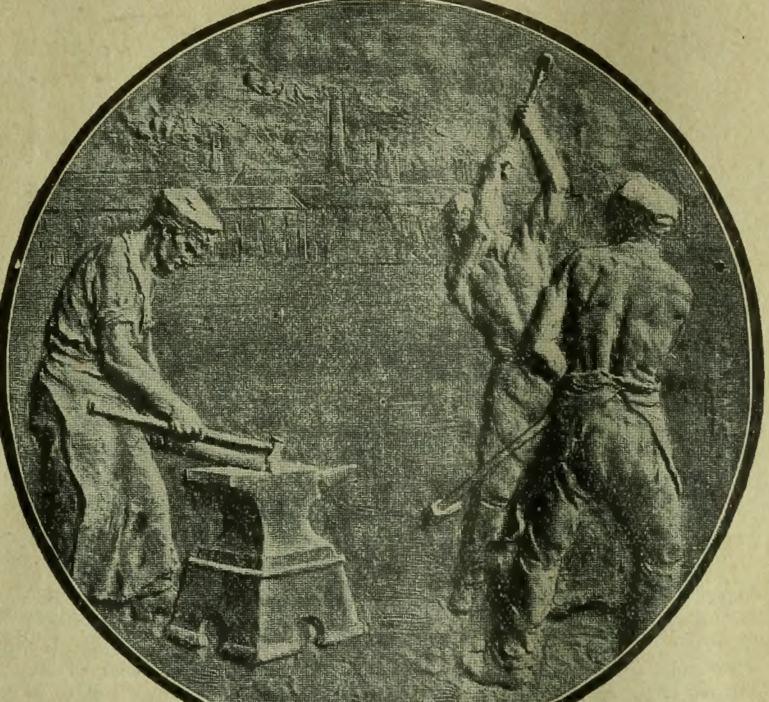
ONTO

PAGE'S WEEKLY



ENGINEERING · ELECTRICITY
SHIPBUILDING MINING
IRON & STEEL INDUSTRIES

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Russia, St. Petersburg : 14, Nevsky Prospect.
Italy, Rome : 307 Corso.
Austria, Vienna : Kärntnerstrasse, nr. 30.

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" Bombay : Thacker & Co., Ltd.
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" Chicago : Subscription News Co.
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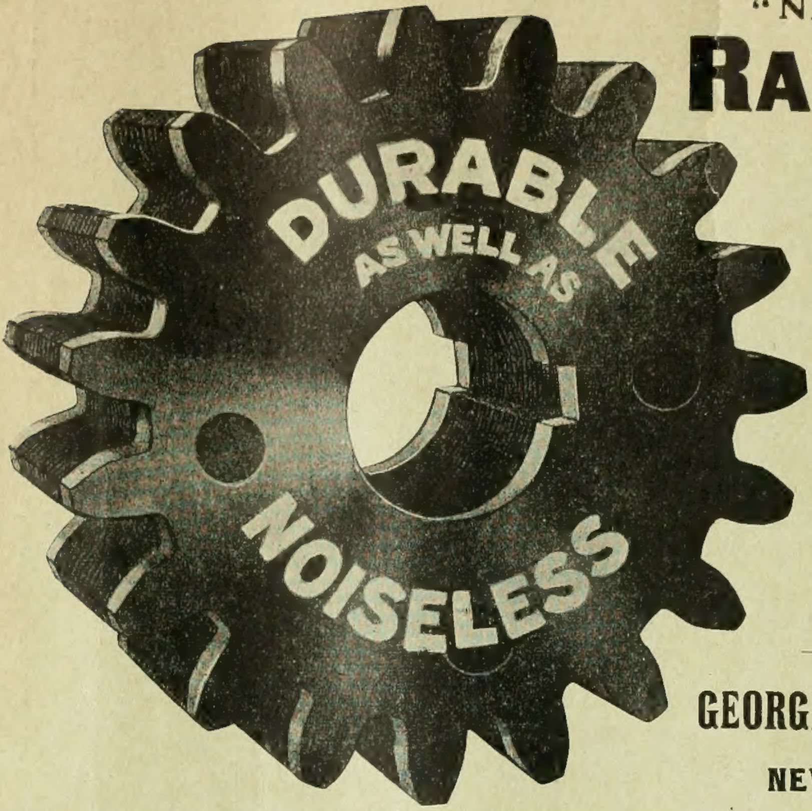

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All Teeth Cut to Brown & Sharpe's Standards.

ALSO METAL GEARS.

Send for Descriptive Catalogue.

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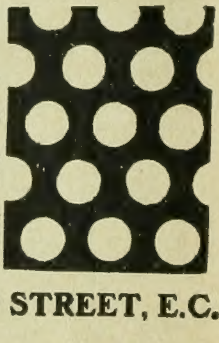
NEWCASTLE-ON-TYNE.

CYCLONE FANS FOR VENTILATION.

MATTHEWS & YATES, Ltd.,
Swinton, Manchester.



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Sole Agents for FR. MEGUIN & CO., Ltd.

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PAGE'S WEEKLY Miscellaneous

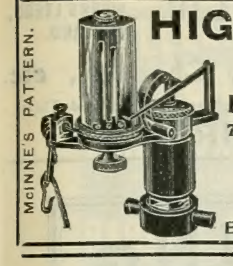
Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

19, OLD QUEEN ST., WESTMINSTER, S.W.

Telephone No.: 5754 Bank. Write for particulars.

HIGH SPEED INDICATORS.


McINNE'S PATTERN.

Hannan & Buchanan,

75, Robertson Street, Glasgow.

ENGINE COUNTERS.

BOURDON GAUGES.

On Admiralty List.

Engineering Instrument Makers

PATENTS.

Mr. J. G. LORRAIN, M.I.E.E., M.I.Mech.E., Fellow of the Chartered Institute of Patent Agents.

NORFOLK HOUSE, NORFOLK STREET, STRAND, LONDON, W.C.

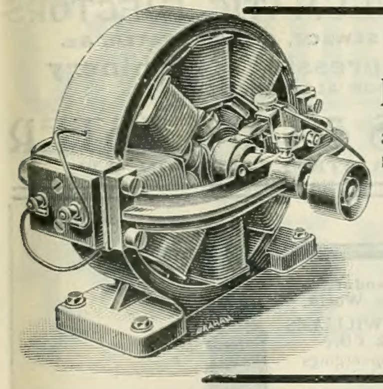
"PATENTEES' HANDBOOK," post free on application, gives Full Information to Inventors and upon all the chief points of the Patent Law.

Telegrams: "Lorrain, London."

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,

615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.

Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.



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3, Tyer's Gateway,
Bermondsey St.,
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Makers of

DYNAMOS,
ALTERNATORS,
ETC.

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COVENTRY, ENG.

Speciality—

FORGING PLANT.

See our Advertisement appearing Jan. 19th.

SEND FOR LATEST CATALOGUE.

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M.I.Mech.E., M.I.M.E.,

Consulting and Mining Engineer for Ore Dressing Plants of All Classes.

II, IRONMONGER LANE, LONDON, E.C.

Tel. Address: "DRESSINGS, LONDON." Telephone No.: 272 Central.

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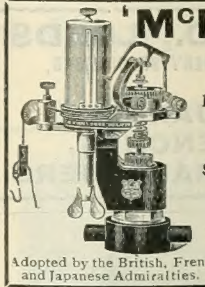

In Two types: External and Enclosed Pressure Springs.

Each made in several forms and sizes to suit all speeds and pressures.

Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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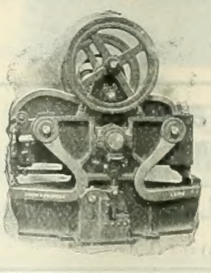
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.

See our Advertisement appearing Jan. 19th, page 37.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.

WORKS—Renfrew, SCOTLAND.



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Shipbuilders' MACHINE TOOLS.

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SAMUEL PEGG & SONS, Engineers,

LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

FOR THE BEST BOOKS BEARING ON THE INDUSTRIES DEALT WITH IN "PAGE'S WEEKLY," viz., ENGINEERING, ELECTRICAL, IRON AND STEEL, MINING AND SHIPBUILDING, ASK FOR CATALOGUE, CHARLES GRIFFIN & CO., LTD., 12, EXETER STREET, STRAND, LONDON, AND SEE SPECIAL ADVERTISEMENT ALTERNATE WEEKS

PAGE'S WEEKLY Miscellaneous

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as your Advertisement Manager.
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I will give my services FREE for the first month, if you will send a penny stamp to defray my travelling expenses.
The BRITISH ADVERTISER,
Queen Anne's Chambers, WESTMINSTER, S.W.

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FIREWOOD & FIRELIGHTER MACHINERY SPECIALISTS,
FOR
SAW GUARDS, BENCHES, SHARPENERS.

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Telegrams: "DESTRUCTOR." Telephone: 2006.
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Samples, Lists, and Testimonials on application.
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Tested to 350 lb. Steam Pressure. For High Pressure Boilers.

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Rolled Steel Joists, Channels, etc.
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THE BEST ROOF FOR ALL PURPOSES
NEAT & STRONG.
FOR TANNERS. IRON FOUNDERS, ENGINEERS.
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SITES INSPECTED & ESTIMATES FREE

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.
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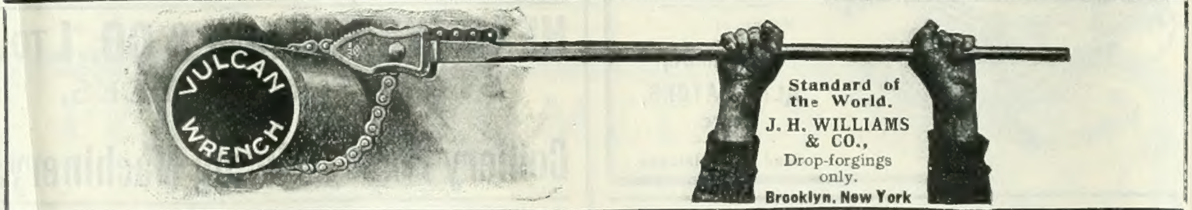
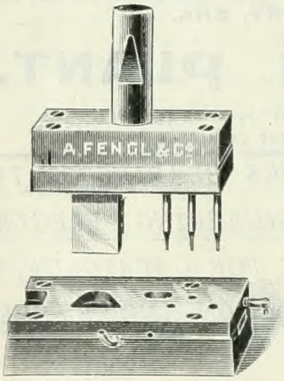
16, VICTORIA STREET, LONDON, S.W.



TEMPERLEY TRANSPORTERS
For Rapid and Economical Handling of General Cargo, Coal, Ore, &c.
See our Advertisement in next week's issue.
TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within,
LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."



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If so, send your requirements, and
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will submit design and price.
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STAMPINGS TO THE TRADE.
Telegrams: "Fengl, Altrincham."

PAGE'S WEEKLY Miscellaneous

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Blue Planished and Glazed Steel Sheets for Lagging

and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS

TO MACHINE CLEAN & BRIGHT ALL OVER.

PARKER FOUNDRY CO. DERBY

ON ADMIRALTY LIST.

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Same odour, same flash point, same result in the working as in genuine Turps. We are the original and only makers of genuine Turpolene.

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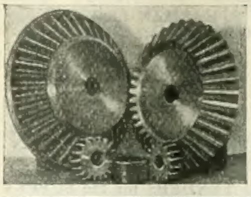
Works: MANCHESTER and WORCESTER.



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Also all kinds of Metal Gearing.

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RIVETS, BOLTS, & SCREWS

Of all Descriptions and for all Purposes.

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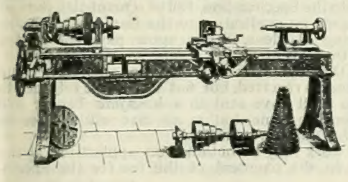
HIGH-CLASS LOAM WORK.

THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. **Send for Estimates.**



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In stock for immediate delivery.

THOS. W. WARD, Lᴰ

Albion Works, SHEFFIELD.

BERTRAMS, Ltd.,

Sciennes, EDINBURGH.

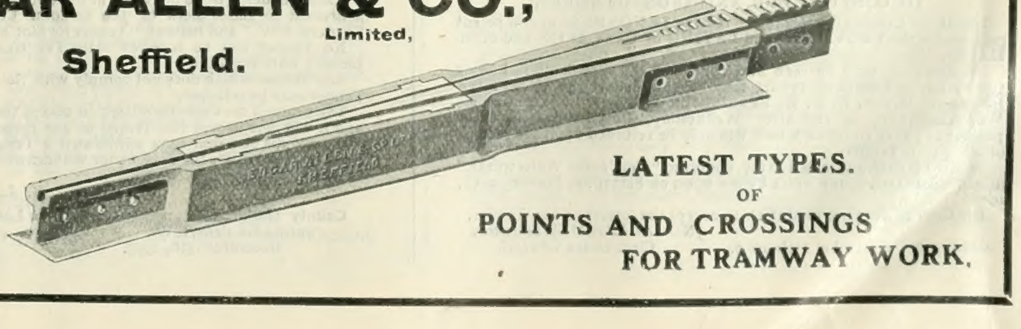
MACHINE TOOLS.

See Next Week.

EDGAR ALLEN & CO.,

Limited,

Sheffield.



LATEST TYPES

OF

POINTS AND CROSSINGS FOR TRAMWAY WORK.

PAGE'S WEEKLY Contracts

CONTRACTS.

LEYTON URBAN DISTRICT COUNCIL.

TRAMWAYS.

TO ENGINEERS.

The Electric Lighting Committee of the Leyton Urban District Council is prepared to receive **TENDERS** for the following **PLANT**:—

(1) 500 KILOWATT DYNAMOS.
(2) OVERHEAD CRANE.

Specifications and Forms of Tender may be obtained from the undersigned, upon a deposit of £1 1s. being made in respect of each Specification required.

Tenders, suitably endorsed, are to be sent for opening at the meeting of the Electric Light Committee, at the Town Hall, Leyton, on January 18th, 1906.

The Council does not bind itself to accept the lowest or any Tender.

By order,
F. HARMAN LEWIS,
Electrical Engineer to the Council.

Electric Light and Power Works,
Cathall Road, Leytonstone,
December 27th, 1905.

CORPORATION OF WIMBLEDON.

TO ENGINEERS.

The Wimbledon Corporation invite **TENDERS** for the **SUPPLY** and **FIXING** of **AIR COMPRESSORS** to be electrically driven, at the Pumping Station, Durnsford Road, Wimbledon.

Plans and Specifications may be obtained on application to the undersigned.

Tenders, endorsed "Air Plant," and addressed to the Chairman of the Highways and Sewerage Committee, must be delivered at the Town Hall on or before noon on Monday, January 22nd, 1906.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
C. H. COOPER, M.I.C.E.,
Borough Engineer and Surveyor.

Town Hall, Wimbledon,
December 20th, 1905.

BOROUGH OF STRATFORD-ON-AVON.

SEWAGE DISPOSAL WORKS.

TENDERS are invited for the **MANUFACTURE, DELIVERY** and **ERECTION** of **THREE SETS** of **GAS** or **OIL ENGINES** and **PUMPS**.

Specification and Drawings may be obtained at the Offices of the Engineers, Messrs. WILLCOX AND RAIKES, Union Chambers, 63, Temple Row, Birmingham, on or after January 1st, 1906, on payment of a deposit of Two Guineas, which will be refunded (after the Contract has been decided upon) to those persons who have sent in a *bona fide* Tender and who have returned the whole of the documents entrusted to them.

Sealed Tenders, upon the forms supplied, endorsed "Stratford-on-Avon Sewage Disposal Pumping Machinery," to be delivered at my office not later than 12 o'clock noon on January 22nd, 1906.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT LUNN,
Town Clerk.

Town Clerk's Office, Stratford-on-Avon,
December 22nd, 1905.

OAKENGATES URBAN DISTRICT COUNCIL.

WATERWORKS.

TO CONTRACTORS AND IRONFOUNDERS.

The above Council is prepared to receive **TENDERS** from competent persons for the **PROVISION** and **LAYING** of **CAST IRON** and other **MAINS**.

The Drawing may be seen and copies of the Specification, Bill of Quantities, and form of Tender, may be obtained at the office of the Engineers, Messrs. R. E. W. BERRINGTON AND SON, Bank Buildings, Wolverhampton, on and after Wednesday, December 20th, upon payment of Five Guineas, which will only be returned upon the receipt of a *bona fide* Tender.

Sealed Tenders, addressed to me, endorsed "Tender for Waterworks," must be delivered at my office before noon on Saturday, January 20th, 1906.

The Council does not bind itself to accept the lowest or any Tender.

JNO. A. HOLMES, Solicitor,
Clerk to the Council.

Oakengates, December 13th, 1905.

CORPORATION OF DURBAN, NATAL.

WATERWORKS EXTENSION.

TENDERS FOR 30-in STEEL PIPES.

The Corporation of Durban, Natal, is prepared to receive **TENDERS** for the **SUPPLY** and **DELIVERY**, "free on board" (and alternately for delivery c.i.f., Durban) of six miles of 30-in. **MILD STEEL PIPES**, weighing approximately 1,500 tons. Three miles to be delivered at Durban not later than June 30th, 1906, and the remaining three miles to be delivered not later than November 30th, 1906.

General Conditions, Specification, and Bill of Quantities, with form of Tender, can be obtained from Mr. W. H. RADFORD, C.E., Albion Chambers, Nottingham, Consulting and Representative Engineer to the Corporation, on deposit of Three Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed and endorsed Tenders must be delivered to the undersigned, Agents to the Durban Corporation, on or before Monday, January 15th, 1906.

The lowest or any Tender will not necessarily be accepted.

By order,
WEBSTER, STEEL, AND CO.,
Agents to the Durban Corporation.

5, East India Avenue, Leadenhall Street, London, E.C.,
December 16th, 1905.

SUPPLY AND ERECTION OF A REFUSE DESTRUCTOR.

TENDERS are invited by the Municipality of Pretoria, Transvaal, for the **SUPPLY** and **ERECTION** of a **REFUSE DESTRUCTOR**, capable of treating 60 tons of refuse per diem.

Tender Forms, Specification of the Destructor, Dimensions, and Levels of the Site upon which it will be erected, may be obtained on application to the Town Engineer, Pretoria, or at the office of Messrs. MOSENTHAL, SONS, AND CO., 72, Basinghall Street, London, E.C.

The successful tenderer will be required to pay to workmen employed on the erection of the above works wages at rates not less, and to observe hours of labour not greater, than the rates and hours set out in a list to be seen at the office of Messrs. MOSENTHAL, SONS, AND CO.; such rates of wages and hours of labour will form part of the contract to be entered into by the successful tenderer.

Tenders, enclosed in sealed envelopes, and endorsed "Tenders for Supply and Erection of Refuse Destructor at Pretoria," must reach the undersigned not later than March 15th, 1906, or the Town Clerk, Pretoria, not later than noon on April 6th, 1906.

The lowest or any Tender will not necessarily be accepted.

MOSENTHAL, SONS, AND CO.,
Representing Municipality of Pretoria.

COUNTY OF LONDON.—TO STEEL RAIL MANUFACTURERS, ENGINEERS, AND OTHERS.

The London County Council invites **TENDERS** for the **SUPPLY** and **DELIVERY** of about 2,300 **TONS** of **STEEL SLOT RAILS** required in connection with the reconstruction, for electrical traction on the conduit system, of certain of the Council's tramways north of the Thames.

Persons desiring to submit Tenders may, on and after Monday, December 18th, 1905, obtain the Specification, Bill of Quantities, form of Tender, and other particulars, on application to the Engineer's Department, County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £2.

This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the Tenderer, provided he shall have sent in a *bona fide* Tender and shall not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted.

Full particulars of the work may be obtained on application at the County Hall previously to the payment of the fee for the Specification, &c.

Each Tender must be upon the official form, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen for work executed under the contract wages at the rates arranged between the employers and workmen in the rail trade in that part of the country where the order is placed.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the "Clerk of the London County Council, Spring Gardens, S.W.," and marked "Tender for Slot Rails, L.C.C. Tramways."

No Tender will be received after Ten o'clock a.m. on Tuesday, January 16th, 1906.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall,
Spring Gardens, S.W.,
December 15th, 1905.

PAGE'S WEEKLY Contracts and Appointments Open

PLYMOUTH CORPORATION WATER-WORKS.

TENDERS are invited for the SUPPLY of the following GOODS and MATERIALS for a period of one year :—

Fire Hydrants
Lead Pipe and Pig Lead,
Stopcocks, Ferrules, &c.
Cast-Iron Work.
Sluice Valves.

Particulars and Forms of Tender can be obtained at this office on and after Monday, January 1st, 1906.

The lowest or any Tender will not necessarily be accepted.

Tenders, enclosed in envelopes provided, to be delivered at this office by Twelve o'clock noon on Tuesday, January 16th, 1906.

FRANK HOWARTH, Assoc.M.Inst.C.E.,
Municipal Buildings, Plymouth, Water Engineer.
December 28th, 1905.

TENDERS FOR CAST-IRON PIPES.—

The Metropolitan Water Board invite TENDERS for the SUPPLY and DELIVERY of about 700 tons of 16-in. CAST-IRON PIPES.

Forms of Tender, with Specification and Conditions of Contract, can be obtained from the undersigned and Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Cast-Iron Pipes, Enfield," must be delivered at the Offices of the Board not later than 10 a.m. on Monday, January 22nd 1906.

A. B. PILLING,
Savoy Court, Strand, W.C., Clerk of the Board.
January 3rd, 1906.

PARISH OF LAMBETH.—BOARD OF GUARDIANS.

The Guardians of the Poor of the Parish of Lambeth hereby invite TENDERS for RE-BUILDING a PAIR of HORIZONTAL ENGINES at their Renfrew Road Workhouse, including new 15 in. cylinders, pistons, connecting-rods, &c., and turning up a 10-ft fly-wheel.

Form of Tender, Specification, and Conditions will be supplied, and draft of Contract may be inspected, on written application to Mr. GEORGE E. ARNOLD, C.E., 26 Victoria Street, Westminster, S.W.

Tenders, which will be received only on the printed form, sealed and endorsed "Tender for Re-building Engines," must be sent to me, the undersigned, by post, not later than Tuesday, January 16th, 1906, and will be opened at the Board Room at noon on the following day.

The Guardians do not pledge themselves to accept the lowest or any Tender.

By order,
W. THURNALL,
Guardians' Board Room and Offices, Clerk.
Brook Street, Kennington Road, S E.,
December 27th, 1905.

SWANSEA HARBOUR TRUST.

CONTRACT FOR WEST PIER EXTENSION.

The SWANSEA HARBOUR TRUSTEES invite TENDERS for EXTENDING seaward the EXISTING WEST PIER.

The extension to be either for 800, 1,000, 1,200, or 1,400 feet, as the Trustees may determine.

Drawings of the proposed work may be inspected at the office of the Trustees' Engineer, Mr. A. O. SCHENK, Mem.Inst.C.E., and copies of the Specification, Conditions, Schedule of Quantities, and Forms of Tender obtained of the undersigned on payment of £2 2s., which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "West Pier Extension," should be delivered to the undersigned at or before 10 a.m. on Thursday, January 18th next.

The Trustees do not bind themselves to accept the lowest or any Tender.

TALFOURD STRICK,
Harbour Offices Swansea, Clerk.
December 22nd, 1905.

ADMINISTRATIVE COUNTY OF LONDONDERRY.

The County Council of the above-named County invite TENDERS, which must be lodged with me on or before Thursday, January 18th, 1906, for the SUPPLY and DELIVERY of :—

ONE STEAM ROAD ROLLER.
ONE ROAD SLEEPING VAN.
ONE WATER CART.

Specifications for the articles required may be seen, or copies obtained, at the office of the County Surveyor, County Courthouse, Londonderry.

Dated this 8th day of December, 1905.

THOMPSON B. ADAMS,
County Courthouse, Londonderry. Secretary to County Council.

APPOINTMENTS OPEN.

CITY OF BRADFORD.—THE CORPORATION

invite APPLICATIONS for the appointment of THREE ENGINEERING ASSISTANTS in the Sewage Works, Engineer's Department, at a salary of £150 per annum each.

Candidates must have had actual experience in the designing and construction of large sewers and works of sewage disposal. Age not to exceed 35.

Applications endorsed "Engineering Assistant," stating age and experience, must be accompanied by copies of two testimonials of recent date, and addressed to me at the Town Hall, Bradford, before January 16th, 1906.

FREDERICK STEVENS,
Town Clerk.

AN "INSTITUTION OF NAVAL ARCHITECTS" SCHOLARSHIP,

of the annual value of £50, and, subject to certain conditions, tenable for three years, will be OFFERED for COMPETITION by the Council of the above Institution.

Candidates must, at the time of the examination, be students of the Institution, and not less than eighteen or more than twenty-one years of age on March 1st, 1906, and must at that date have been continuously employed for two years upon Naval Architecture or Marine Engineering.

Further particulars and forms of entry and conditions regulating the admission of students, may be obtained from the Secretary, Institution of Naval Architects, 5, Adelphi Terrace, London, W.C.

Applications must be sent in by February 1st, 1906.

LONDON, BRIGHTON, AND SOUTH COAST RAILWAY COMPANY.

SIGNAL SUPERINTENDENT.

The Directors of the above Company are prepared to receive APPLICATIONS for the POST of SIGNAL SUPERINTENDENT in the Permanent Way Department of the Railway. Salary, £300 per annum.

Applications, giving full particulars of past experience, and stating age, which must not exceed 35 years, should be sent to me by post, in an envelope marked "Signal Superintendent," so as to be delivered at my office not later than 10 o'clock a.m. on Friday, January 19th, 1906.

J. J. BREWER,
Secretary's Office, Secretary.
London Bridge Terminus, S.E.,
December 28th, 1905.

SWADLINCOTE DISTRICT URBAN DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR AND WATER ENGINEER.

The Council invite APPLICATIONS for the above APPOINTMENT.

The gentleman appointed will be required to devote his whole time to the duties of his office.

The salary as Surveyor will be £250 per annum, and as Water Engineer to the Joint Water Committee of Swadlincote and Ashby-de-la-Zouch £40 per annum.

The Council district contains an area of 3,415 acres, a population of 19,500, and a rateable value of £65,000.

The Waterworks are situate at Milton and Woodville.

Applications, in candidates' own handwriting, stating age and qualifications, with three recent testimonials, must be sent to me, the undersigned, at the Council Office, not later than Wednesday, January 31st, endorsed "Surveyor."

Three months' notice at any time to determine the engagement.

Canvassing, either directly or indirectly, will be deemed a disqualification.

By order of the Council,
W. A. MUSSON,
Council Office, Clerk.
Belmont Street, Swadlincote,
January 3rd, 1906.

CITY OF AUCKLAND, NEW ZEALAND.

APPOINTMENT OF CITY ENGINEER.

Applications, accompanied by Testimonials, will be received in the Town Clerk's Office, Auckland, New Zealand, until 4 o'clock p.m. on Thursday, February 8th, 1906, for the appointment of City Engineer to the City of Auckland. Conditions of appointment may be seen, and copies obtained, at the office of the High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W.

HENRY W. WILSON,
September 1st, 1905. Town Clerk.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 22 and 24.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Band Sawing Machines.
Noble & Lund, Ltd., Felling-on-Tyne.

Bearings (Roller).
Hyatt Roller Bearing Co., 47, Victoria Street, London S.W.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Hartley & Sugden, Ltd., Halifax.
Thompson, John, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T, D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.

Cables.
Callender's Cable and Construction Co., Ltd.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
Clayton, Son & Co., Ltd., Hunslet, Leeds.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 19, Old Queen Street, Westminster, S.W.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.
Mount-Haes, A., M.I.Mech.E., M.I.M.E., 11, Ironmonger Lane, London, E.C.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Copper and Brass.
W. Hepton & Son, Hunslet Lane, Leeds.

Coverings (Boiler).
Magnesia Covering Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne
Swift, George, Clarence Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 16, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, Strand, London, W.C.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Johnson and Phillips, Ltd., Victoria Works, Old Charlton, Kent.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Scott, E., & Mountain, Ltd., Newcastle-on-Tyne.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Cundall, Son & Co., Ltd., Airedale Iron Works, Shipley.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
Matthews & Yates, Ltd., Swinton, Manchester.

Files.
Flockton, Tompkin & Co., Ltd., Newhall Steel Works, Sheffield.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E,

BULLIVANTS' STEEL WIRE ROPES

FOR CABLE TRAMWAYS, INCLINES, COLLIERIES, MINES.

FLEXIBLE & EXTRA FLEXIBLE STEEL WIRE ROPES FOR SHIPS' HAWSERS, RUNNING AND STANDING RIGGING.

ROPES FOR CRANES, LIFTS, HOISTS, DERRICKS, PURCHASE & CARGO FALLS &C.

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Regd Office: 72 MARK LANE, LONDON E.C.
Works: MILLWALL, LONDON E.
TELEPHONE No 2110 AVENUE. TELEGRAPHIC ADDRESS: "BULLIVANTS" LONDON.

AGENCIES

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JOHANNESBURG.

18 CROOKED LANE.
LIVERPOOL.

GREAT GRIMSBY COAL, SALT & TANNING Co LTD GRIMSBY
ABERDEEN & FLEETWOOD
69 ALBION STREET LEEDS

Contractors for Aërial Ropeways on all Systems. and Mining and Hauling Plant.

Blocks, Pulleys, Crab Winches, and all Appliances for working Wire Ropes.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Angus, G. & Co., Ltd., Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Dixon, W. F., & Co. 60, Percival Street, C. on-M. Manchester
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Swift, George, Clarence Ironworks, Halifax.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Buckley, Saml., St. Paul's Square, Birmingham.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England
Flockton, Tompkin & Co., Ltd., Newhall Steel Works, Sheffield.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Lathe Carriers
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Beanland, Perkin, & Co., School Close Works, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Dempster, Moore & Co., Ltd., 49, Robertson Street, Glasgow.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Resides, 12, Aire Street, Brighouse, Yorks.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Clarence Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Drill Steel.
Flockton, Tompkin & Co., Ltd., Newhall Steel Works, Sheffield.

Mining Machinery.
Fraser & Chalmers, Ltd., 3 London Wall Buildings, London, E.C.

Office Appliances.
Davis, John, & Son, Ltd., 30, All Saints' Works, Derby.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rookwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

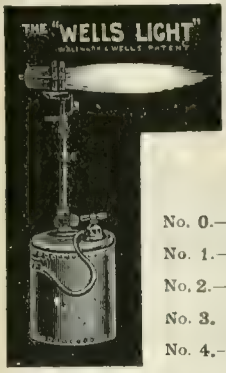
Oil Filters and Cabinets.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agent.
Lorrain, J. G., M.I.E.E., M.I.Mech.E., Norfolk House, Norfolk Street, Strand, London, W.C.

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED

Horizontal Flame Unaffected by Weather.

OVER 18,000 SOLD

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern, with No. 2 size burner for Tar Oil ..	£10 0 0
No. 2.—1,500 Candles, useful and portable pattern	£15 10 0
No. 3. 2,500 Candles, Manchester Ship Canal pattern	£16 10 0
No. 4.—3,500 Candles A most powerful lamp...	£17 15 0

These Lamps are arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

No. 50 "STANDARD" LAMP.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil burning six hours.

Price **£3** each

Extra Burners **3/-** each.

WELLS' STANDARD" OIL GAS LAMP No 50

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration)	£25 0 0
No. 2 ,, ...	£30 0 0
No. 3 ,, ...	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS, Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

Price, Complete £16

Hand Sprayer and Hose supplied separately, £9.

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints. Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal for Lightness and Strength, with large Capacity.

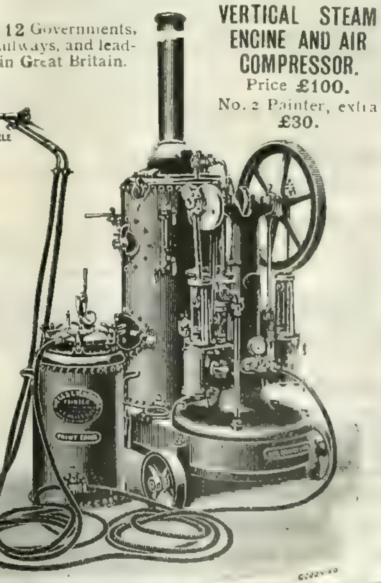
Price, with Single Burner...	16/- each.
,, Double ..	19/-
Tripod Stands	3/- ,,
Extra Burners	2/-

Supplied to 12 Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price **£100.**

No. 2 Painter, extra **£30.**



OVER **500** PLANTS SOLD.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,
LONDON, N.W.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester
B. J. Hall & Co., 39, Victoria Street, London S.W.

Photographic Apparatus.

Marion & Co., Ltd., 22 and 23, Soho Square London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Pneumatic Tools.

Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 33 Brook Street, Bradford
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds
Mitchell, D., & Co. Ltd., Parsonage Works, Keighley
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax

Rails.

Wm. Firth, Ltd., Leeds

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Clayton, Son & Co., Ltd., Hunslet, Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.
McTear & Co., Ltd., Newtownards Road, Belfast.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.
Pohlig, J., Ltd., Cologne, Germany.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Slotting Machines.

Swift, George, Clarence Ironworks, Halifax

Spanners.

Williams, J. H., & Co., Brooklyn, New York U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd. Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
Clayton, Son & Co., Ltd., Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel (Tool Steel).

Flockton, Tompkin & Co., Ltd. Newhall Steel Works, Sheffield.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 49, Deansgate Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100b, Queen Victoria Street, London, E.C.

Tubes.

Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

Typewriters.

Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hopkinson, J. & Co., Ltd., Britannia Works, Huddersfield.
Hunt & Mitton Crown Brass Works, Oozells Street North, Birmingham
Scotch and Irish Oxygen Co., Ltd. Rosehill Works, Glasgow
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

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Matthews & Yates, Ltd., Swinton, Manchester

Water Softeners and Purifiers.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

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Thornycroft & Co., J. I., Ltd., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wire Working Machinery.

Ed. Brand 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

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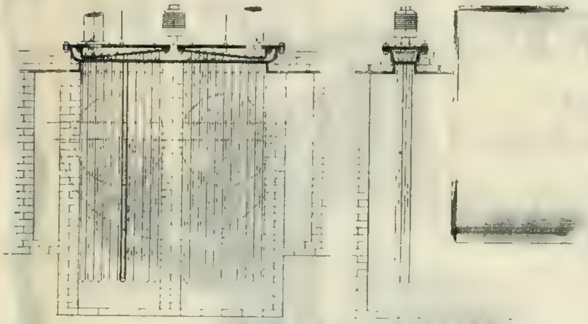
TO STEAM USERS.



OVER 400 WORKING,

Averaging a saving of 15 per cent. of coal and 30 per cent. of water. Repeat Orders coming in.

RELIEVE YOUR BOILERS.

Increase the efficiency of your Engines and improve Production by placing BOLTON'S SUPERHEATER in the Back or Downtake Flue.

To Dry and Superheat the Steam.

For Particulars write to Patentees and Sole Makers—

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Engineers and Contractors,
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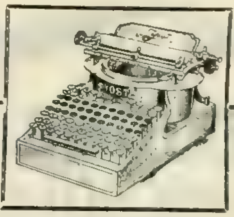

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Made of Best Materials only.

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The JOS. C. NICHOLSON TOOL Co.,

Engineers and Machine Tool Makers,

Sole Proprietors and Manufacturers of

THE "BEAR" PATENT SMOOTH-GRIP

The only perfect Frictional Pipe Wrench in the Market. Why buy Foreigners?

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CITY ROAD TOOL WORKS, NEWCASTLE-ON-TYNE.

OIL SEED AND CAKE MILLS.

GRAB DREDGERS.

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Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.

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WATER SOFTENING PLANT.

GREENWOOD & BATLEY, Ld.

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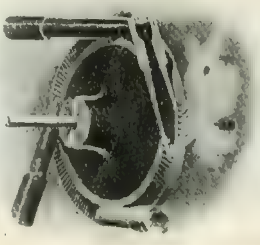

Machine Tools.

Dynamos & Motors.

De Laval's Patent Steam Turbines.

PAGE'S WEEKLY Machine Tools

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CLARENCE IRON WORKS · *HALIFAX, England.*

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Slotting Machines

From 6 in. to 18 in. Stroke.

Complete Catalogue on request.

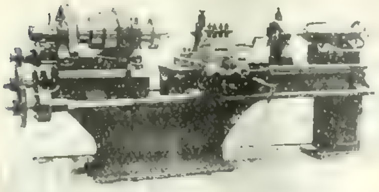
These Machines are exceptionally rigid in the table and slides, and are excellent [illegible]

8 in., 10 in., and 12 in. Machines always in progress.

Accompanying illustration is of my **8 in. STROKE MACHINE,** with Balanced Ram, Quick Return and Canting Table. Shall be glad to submit full particulars of this or any other of my tools on application.

INQUIRIES SOLICITED.

HIGH-CLASS LATHES & RADIAL DRILLS.



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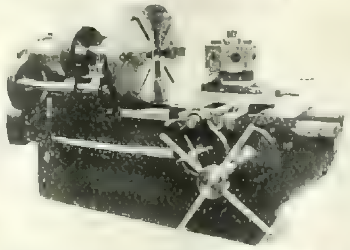
D. MITCHELL & CO., Ltd., Parsonage Works, KEIGHLEY.

On War Office and India Office Lists.

C. REDMAN & SONS

Parkinson Lane, HALIFAX.

Established 1871.



LATHES, PLANERS, ETC., Our SPECIALITY.

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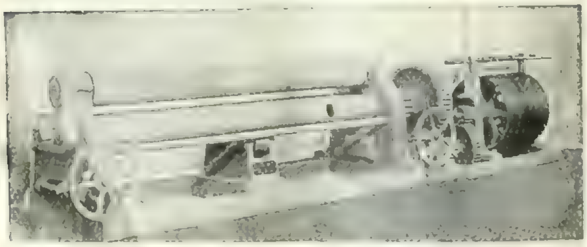
For the Latest and most Up-to-Date

HEAVY MACHINE TOOLS



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Also Special Lifting Jack for Electric Tramcars.

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GEORGE ADDY & Co.,
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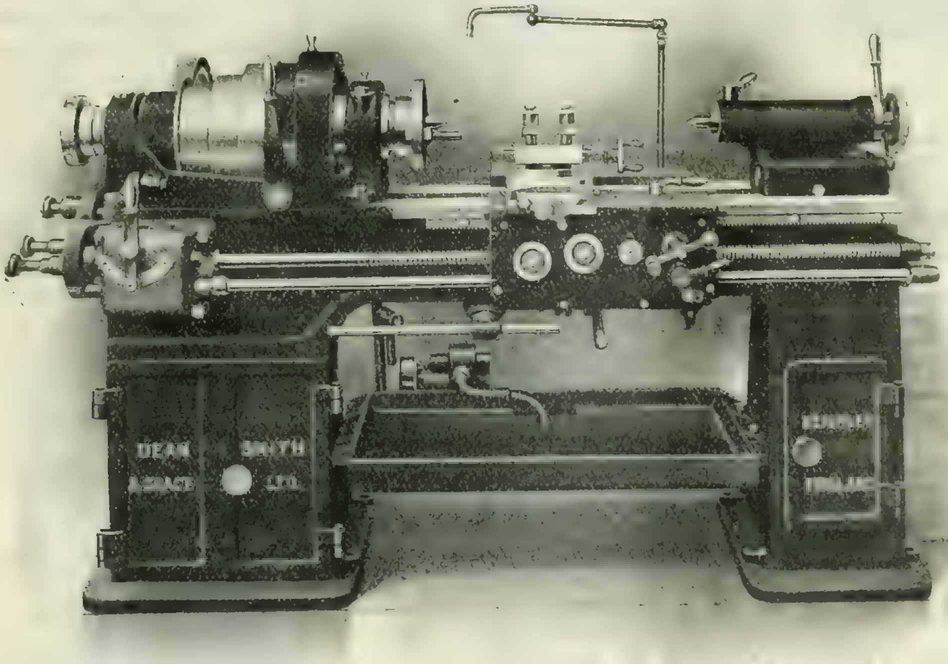
High-Speed Lathes

FOR ALL CLASSES OF WORK

are our sole Manufacture.

SPECIAL DESIGNS. UNIQUE FEATURES.



6-in. High Speed Lathe, with Friction Geared Head and Hollow Spindle, taking 2½ in dia. Bar.

IF INTERESTED, WRITE FOR OUR 1906 CATALOGUE.
IT WILL BE WORTH YOUR WHILE.

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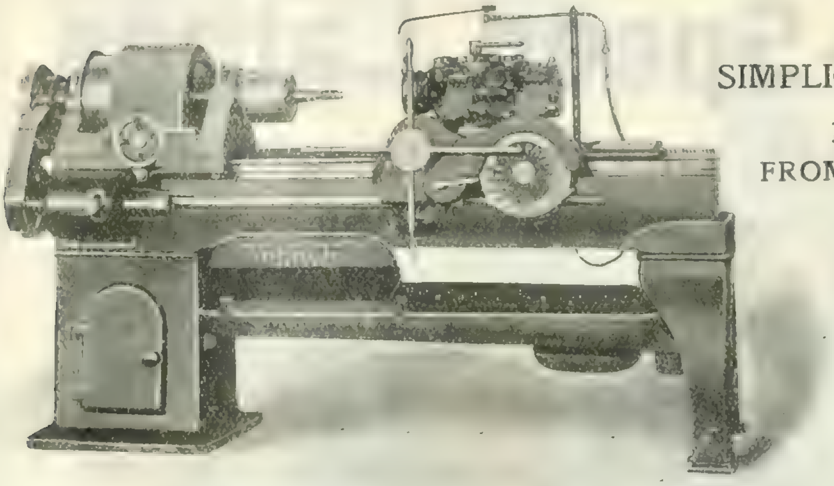
England.

ESTABLISHED
1865.

Agents for London: BUCK & HICKMAN, Ltd., Whitechapel Rd., E.
Agent for France: LOUIS BESSE, 39, Rue de Lappe, Paris.

PAGE'S WEEKLY Machine Tools

TURRET LATHE SPECIALISTS.



Note the
SIMPLICITY of this LATHE.

DIRECT DRIVEN
FROM THE MAIN SHAFT.

VARIABLE SPEED HEADSTOCK.

The RACK and GUIDE direct under the cutting tool being completely covered.

ALL HANDLES and STOPS within reach of the Operator.
THE ONLY CORRECT GRIP CLUTCH.

Telegrams: "CRITERION, LINWOOD."
Telephone: 4Y JOHNSTONE.

ECLIPSE TOOL MFG. CO., Linwood, nr. Glasgow.

WE
WELCOME
ALL VISITORS TO
OUR WORKS
WHO ARE INTERESTED IN
LATHES.

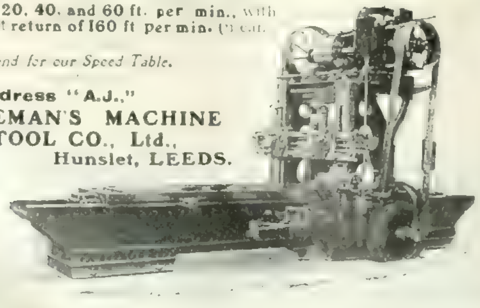
JOHN LANG & SONS, Johnstone, nr. GLASGOW.

BATEMAN THREE-SPEED PLANERS

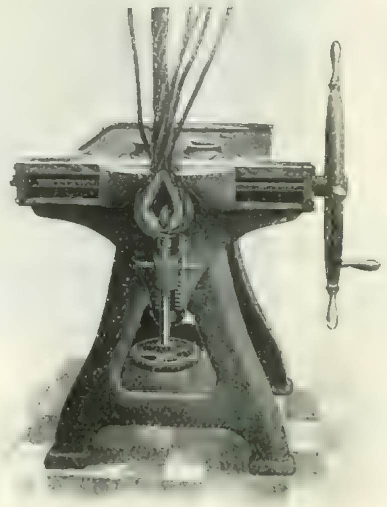
The Machine illustrated has a variable cut of 20, 40, and 60 ft. per min., with constant return of 160 ft per min. [illegible] cut.

Send for our Speed Table.

Address "A.J.,"
BATEMAN'S MACHINE TOOL CO., Ltd.,
Hunslet, LEEDS.



36 in. x [illegible] in. x 12 ft., with three-speed gear box



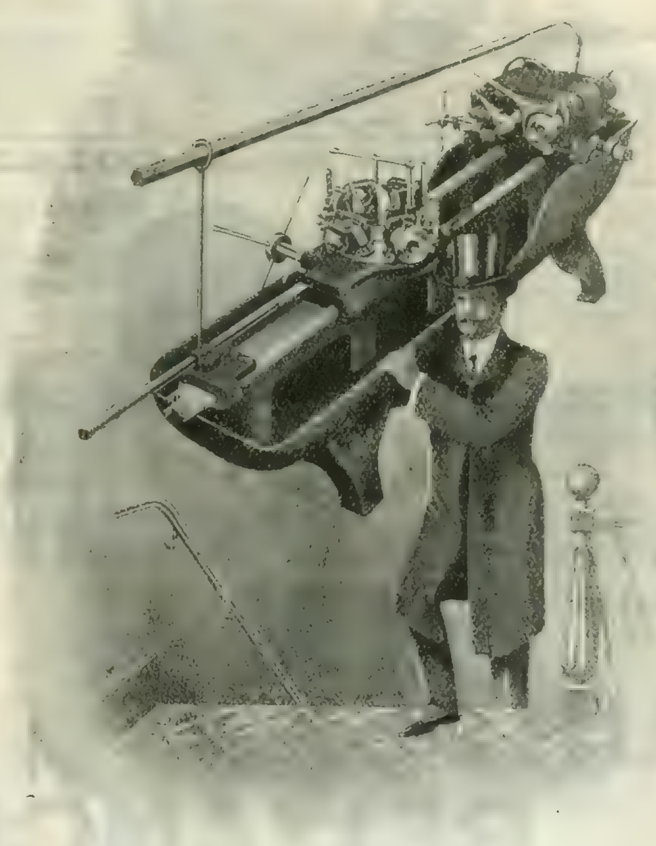
Cable Bending and Splicing Vise.

SEND FOR DESCRIPTION

J. PARKINSON & SON,
SHIPLEY, ENGLAND.

Cables: "TEMPLES, SHIPLEY." Code: A B C 5th Edition.

It would be Impossible



For our Representative to carry a machine on his shoulder

when he comes to interview you regarding the purchase of a Hartness Flat Turret Lathe,

But, if you will call at our premises,

97, Queen Victoria Street, London, one of our expert operators will take very great pleasure in demonstrating to you the merits of our New Model Hartness Flat Turret Lathe, with Cross Sliding Head,

☛ **The only Turret Lathe of the kind on the Market.**

COME AND SEE IT WORKING.

JONES & LAMSON MACHINE CO.,

"Jubilee Buildings," 97, Queen Victoria Street, LONDON, England.

TELEGRAMS: "TURRETORUM, LONDON."

TELEPHONE No.: [illegible] BANK LONDON.

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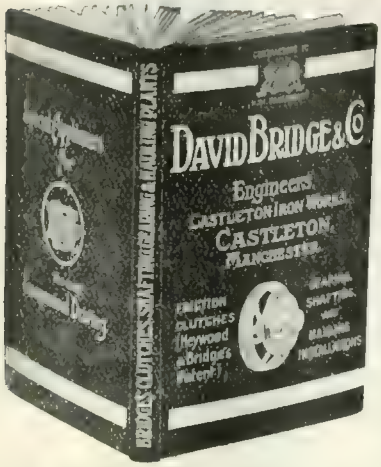
PAGE'S WEEKLY Machine Tools, &c.

Heywood and Bridge's

PATENT FRICTION CLUTCHES, GEARING & HAULING PLANTS.


DAVID BRIDGE & Co
Engineers
CASTLETON IRON WORKS
CASTLETON
MANCHESTER
FRICTION CLUTCHES (Heywood & Bridge's Patent)
GEARING, SHAFTING, AND HAULING INSTALLATIONS
BRIDGE'S CLUTCHES SHAFTING GEARING & HAULING PLANTS

Specify our Clutches and you will not regret it.

200 PAGE BOOKLET FREE on application.

It will tell you all about our Clutches and Gears.

DAVID BRIDGE & CO.,
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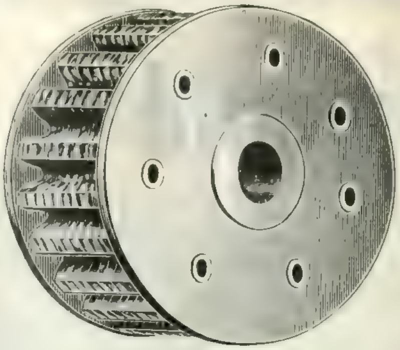


Made up to 400 B.H.P.

Buffalo-Raw-Hide Silent Gears.

MOST DURABLE, BEST FINISHED, & BEST VALUE in the Market.

Send for particulars.

Electric Hauling GEARS

Main and Tail, Main Rope, Endless Rope and Portable, Hoisting, and Hauling Gears.

M. B. WILD & CO., ARGYLE STREET, NECHELLS. BIRMINGHAM.

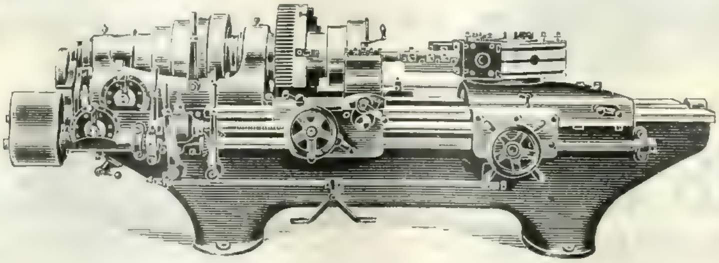
THE LATEST DEVELOPMENT IN HIGH-SPEED

TURRET LATHES

IS

BRADBURY'S RELIANCE.

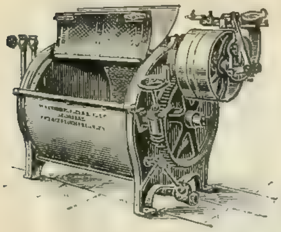
It has decided advantages over any other Machine on the market.



Prices, Full Details, and Estimated Output per Day from

BRADBURY & CO., Ltd., Wellington Works, **OLDHAM.**

PAGE'S WEEKLY Machine Tools, &c.



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MACHINERY
and Steam COOKING APPARATUS.

Please write for our New Catalogue, **N.**

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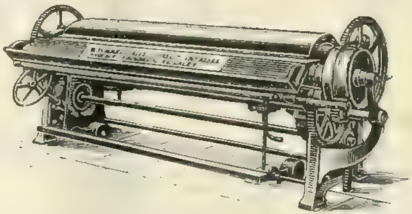

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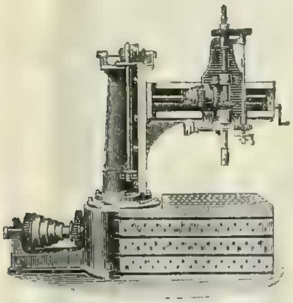
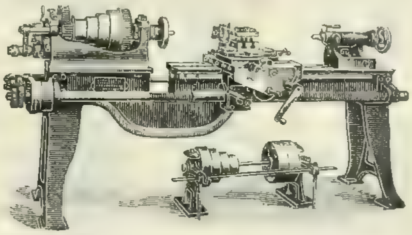
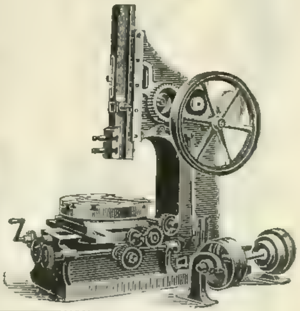
ENGINEERS, GLASGOW.

Modern Machine Tools of all Kinds.







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Ask for Descriptive Sheet.

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Planing . . Machines.

SPECIAL FEATURES
Deep Bed, Strong Table
Unrestricted Belt Angle,
All Gears and Rack Cut
Absolutely No Shock when Reversing.

REVISED PRICES.

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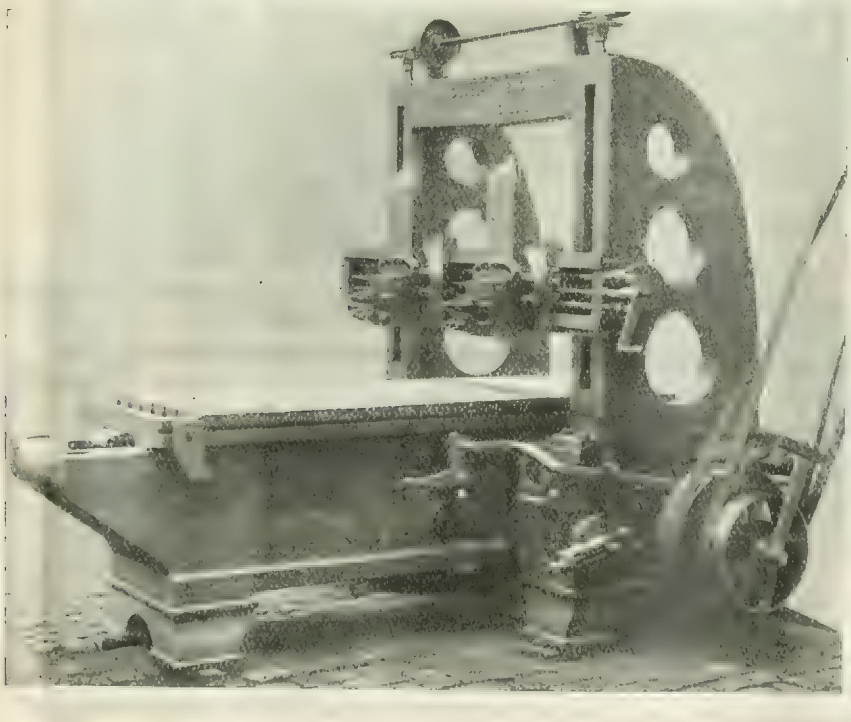

PAGE'S WEEKLY Miscellaneous

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FLOODGATE S^T WORKS
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TELEGRAPHIC ADDRESS
"FLOODGATE" BIRMINGHAM.
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FORGINGS.

Cranks and Forgings of Every Description in Stock.

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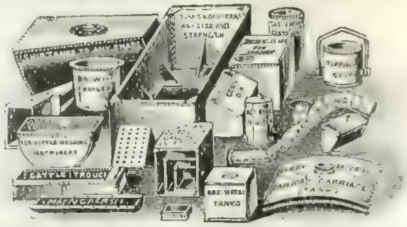
F. A. KEEP, JUXON, & CO.,
Manufacturers of
TANKS, CISTERNS
and CONSTRUCTIONAL IRONWORK.



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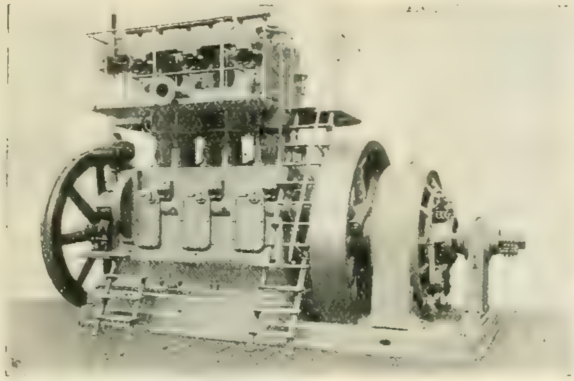
STEEL CONSTRUCTION
IN ALL BRANCHES
Buildings Designed and Erected in all Parts of the World.
ROOF FRAMES, TRUSSES AND GIRDERS,
BLAST FURNACES AND STEEL WORKS, CUPOLAS, LADLES, CONVERTERS,
BOILERS, TANKS, AND HEAVY PLATE WORK.
GAS HOLDERS, PURIFIERS, ETC.,
OPEN HEARTH FURNACE CASINGS
CHIMNEYS, RIVETED PIPE, CORRUGATED IRON.
RITER-CONLEY MFG., CO., PITTSBURG, P.A., U.S.A.
New York Office: 39-41, Cortlandt Street.

PAGE'S WEEKLY Gas Engines, &c.

Westinghouse Gas Engines



220 B.H.P. Westinghouse Producer Gas Engine, direct-coupled to a Westinghouse three wire D.C. Dynamo. As supplied to Henley's Telegraph Works Co., Ltd.

are

Vertical, Multicylinder, and Enclosed, and may be operated with either Illuminating, Producer, Blast-Furnace, or Coke-Oven Gas.

Suitable for all classes of Service, but more particularly for Electric Lighting and Power.

Perfect Speed Regulation.

The British Westinghouse Electric & Manufacturing Co., Ltd.,
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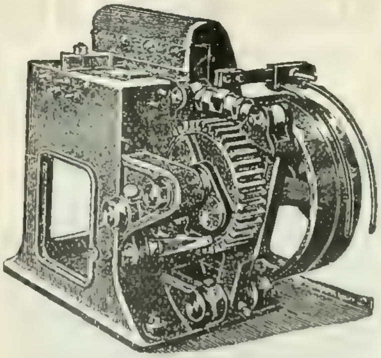
C. W. Hasenclever Söhne
DÜSSELDORF.

Special Machinery

FOR MAKING

Bolts, Nuts, Rivets,
Insulator Brackets,
Horse-Shoes,
Horse-Shoe Nails,
Calkins, and
Similar Forgings.



ROLLING MACHINE FOR IRON SCREW THREAD.

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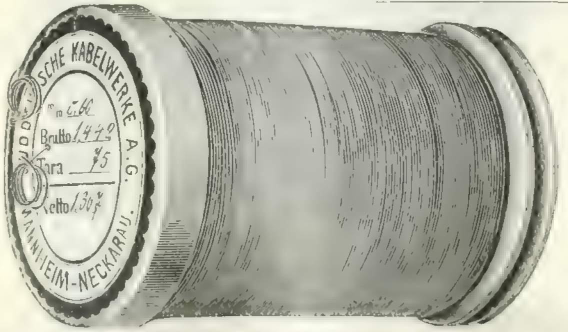
Repairs to all kinds of **Hulls & Machinery** of
Ships, Yachts, Motor Launches, &c.

JOHN I. THORNYCROFT & Co., Ltd., Woolston Works, SOUTHAMPTON.

SÜDDEUTSCHE KABELWERKE A.-G., Mannheim,
(SYSTEM BERTHOUD BOREL.) GERMANY.

Contractors to the Imperial German Postal Authorities.



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TELEPHONE CABLES.
With Paper and Air Insulation.

LEAD-COVERED CABLES
For all Tensions up to 40,000 volts.

FOR CHEAP POWER.

The Cundall
Patent Suction Gas Engine
and Producer Plant.

CUNDALL, SONS, & CO., Ltd., Shipley, YORKS.

London Office and Showrooms : **20 & 22, ST. BRIDE STREET, E.C.**

Telephone No. : **4 Shipley.** Telegrams : **"Cundall, Shipley."**

SOMETHING NEW.

How to deal with Inward Invoices.

Does your present system involve the looking through a mass of detail before arriving at any required invoice?
If it does, then you are wasting your time.

YOU CANNOT AFFORD TO DO THIS.

THINK OF THE SAVING

if you adopt a system that will enable you to find any required invoice at once.

YOU OUGHT TO KNOW SOMETHING ABOUT THIS.

PARTICULARS OF

The Trading & Manufacturing Co.,
C.I. DEPT., Ltd.,
27 & 28, FLEET STREET, LONDON, E.C.

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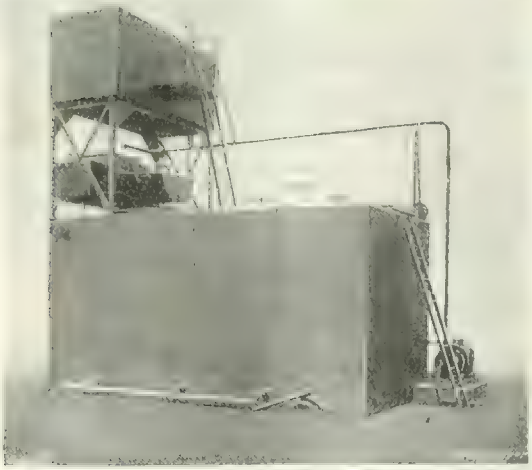

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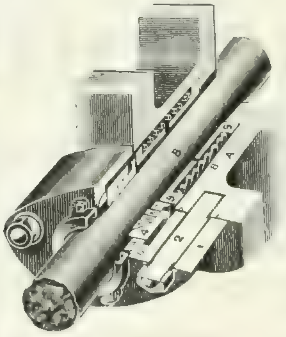

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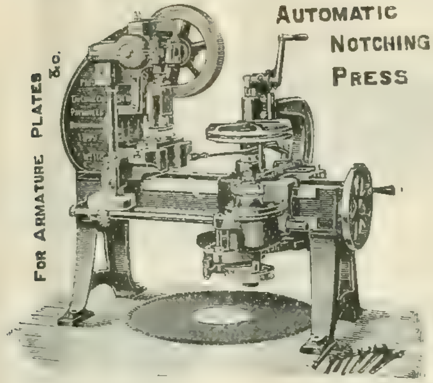

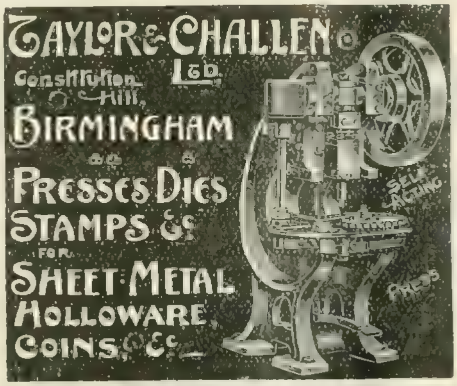

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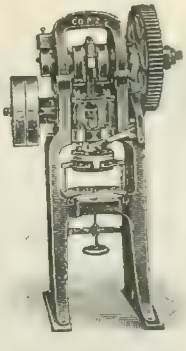

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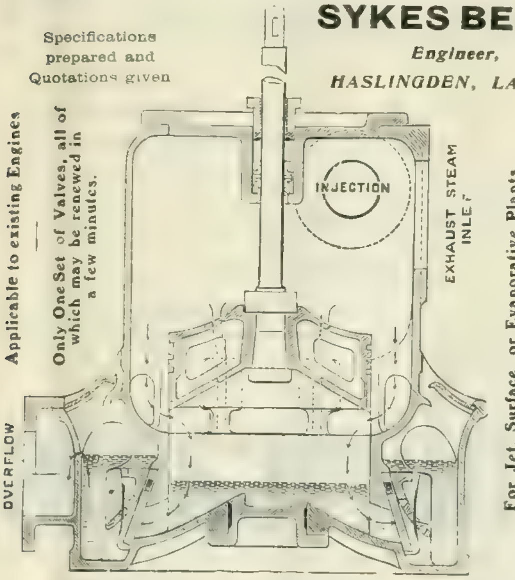

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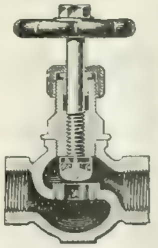

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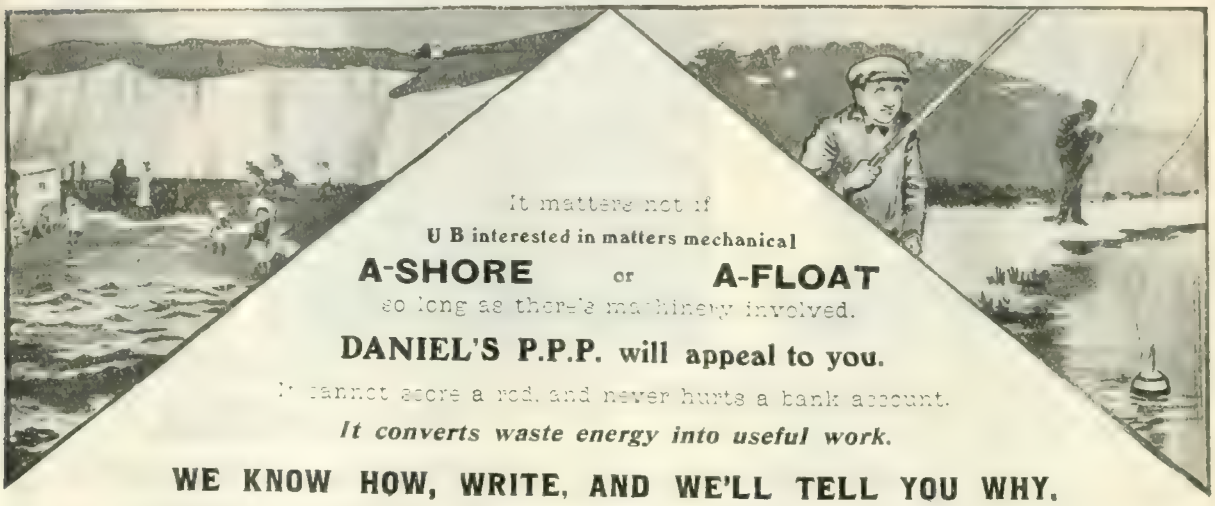

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VIII. LONDON, FRIDAY, JANUARY 12, 1906 No. 70

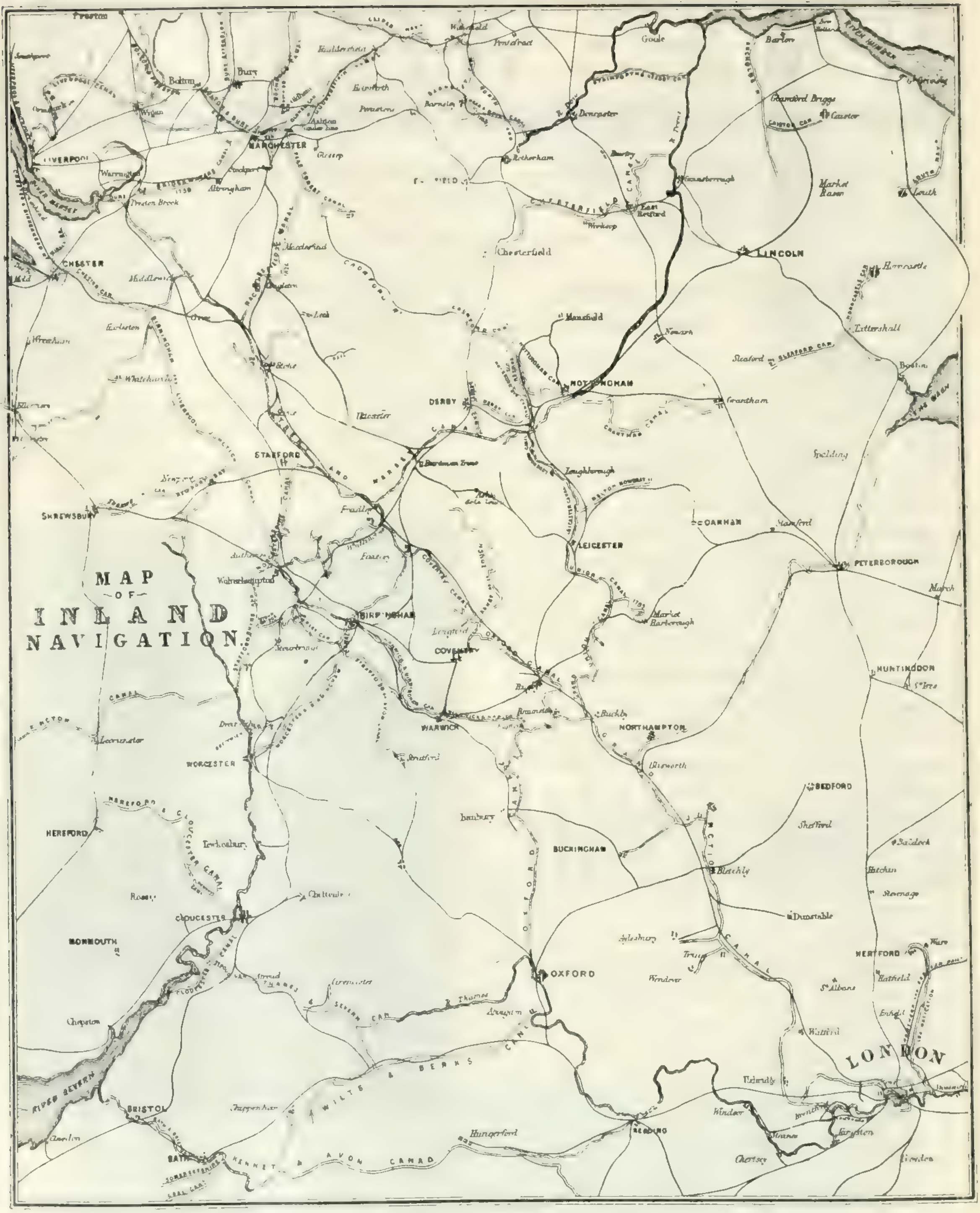
The Offices of "Page's Weekly,"
Wednesday Evening.

THE appointment of Sir George Gibb as successor to the late Mr. Yerkes has evoked a widespread and cordial approval. The new deputy-chairman and managing-director of the Underground Electric Railways Company and chairman and managing-director of the Metropolitan District Railway, is a man of ripe experience; not only does he possess a sound knowledge of railway economics, but his legal attainments are such as to make him familiar with all matters connected with the railway work which come before Parliament or the Railway Commissioners. Born in Aberdeen about fifty-six years ago, Sir George is the youngest son of a civil engineer. His connection with railways began when, in 1877, he joined the staff of the Great Western as an assistant solicitor. Later on he had an independent practice in Fenchurch Avenue, but in 1882 he went back to railway administration, having been appointed solicitor to the North Eastern. In 1891 he became general manager of that company, and in addition to the many improvements effected during his tenure of office, there have been remarkable developments in the passenger and freight traffic—the latter having increased 38 per cent. since it has been under Sir George Gibb's control. Foremost among the pioneers of scientific traffic working, the experiments in electrification carried out by the North Eastern were due mainly to his initiative. In 1897, when a general strike occurred, he acted as arbitrator in wages for the company before Lord James of Hereford, and by his diplomacy averted the more serious consequences of the dispute. Sir George Gibb was appointed in 1901 to serve on the Committee on War Office Reorganisation, and, as is well known, he is a member of the London Traffic Commission.

Photo, Elliott and Fry.

SIR GEORGE S. GIBB, LL.B.,

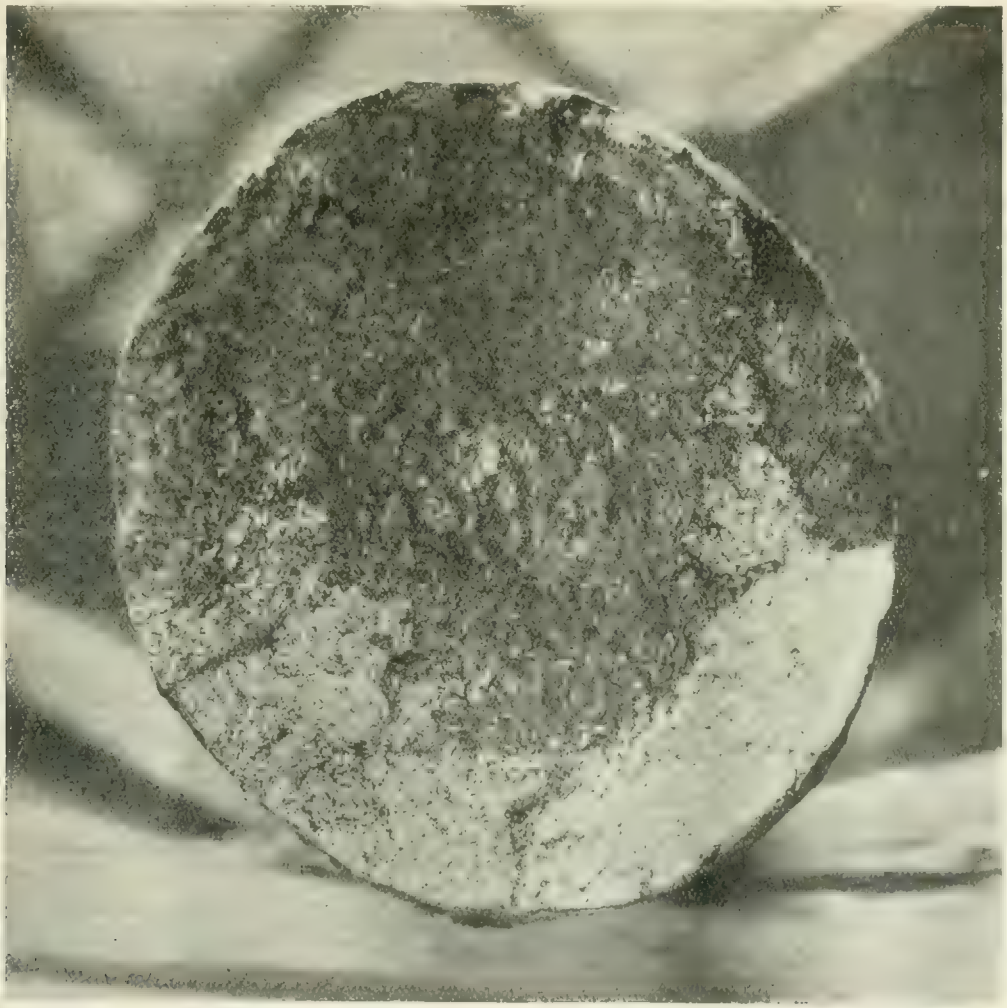
Recently appointed Deputy-Chairman and Managing Director of the Underground Electric Railways Company, and Chairman and Managing Director of the Metropolitan District Railway.



SHOWING MAIN ROUTES OF ENGLISH INLAND WATERWAYS. (*See page* 82.)

The canal problem promises once more to become a live question; and in the series of articles, the first of which appears in this issue, the subject of inland waterways will be dealt with in detail. The map which appears on page 58 shows the chief waterways of England, and the proposed main routes, it will be seen, are already in existence, although it would be necessary to spend a considerable sum of money to make these waterways practicable highways for through traffic. It is easy, of course, to formulate schemes for the improvement of English inland waterways, which are a splendid commercial asset allowed to run to waste, but in the absence of assistance by public authorities, it would be difficult to raise the necessary capital to reform our canal systems. On the present traffic it would not be easy to show that a fair return on capital could be earned, and that is why the State should step in and render financial aid.

The interesting photograph published on this page tells to an experienced eye the whole story



THE CHARING CROSS ROOF COLLAPSE.
This illustration shows the fractured end of the broken tie-rod which caused the fall of the station roof.

of the Charing Cross disaster. Our illustration shows the condition of the broken tie rod which caused the collapse of the roof of Charing Cross Station, and approximates to the exact size; the tie rod, which was in the third panel, being 4½ in. in diameter. It may be mentioned that the width between the walls of the station is 164 ft., and that the roof is carried by 14 main principals. The principals were 35 ft. apart, and there were nine panels in each. The diameter of the tie rod varied in each panel, the maximum being 5 in., and the minimum 4¾ in.

Mr. P. C. Tempest, the chief engineer to the managing committee of the South Eastern and Chatham Railways, to whose courtesy we are indebted for the illustration, pointed out at the adjourned inquest held on Monday last that snapping of the tie rod was due to a bad weld, and it is quite obvious to anyone who examines the photograph, that only a portion of the metal was in contact. Sir Benjamin Baker, who is the consulting engineer of the railway company, was emphatic that the defect in the tie bar dated from the time of manufacture, and was due to a defective weld. At the present day a tie bar would, of course, be made out of a solid ingot of steel without any weld, but 42 years ago, when the Charing Cross roof was constructed, the process adopted was quite the correct one. Indeed, as Sir Benjamin Baker pointed out, ever since the introduction of chain cables every link of chain has had to be welded in the same way as these bars, and battleships depend for their safety upon the efficiency of the scarf weld.

There is thus no mystery about the Charing Cross roof collapse. The tie rod, by reason of the extension of this original flaw, had, at the time of fracture, only about one-third of its area in metallic contact, and it might have given way at any moment. Sir Benjamin Baker admitted that if there was no metallic [illegible] in the centre of the tie bar when welded, he knew of no practical way of discovering the flaw except by a laboratory process. Flaws of this kind are a recognised danger in roofs of the Charing Cross type. Sir Benjamin Baker said that in his experience he had seen other roofs constructed on similar lines with a single tie rod, and this was the first failure he had ever known.

When the Charing Cross roof was built it was up to the highest engineering standard of the time. In the course of cross-examination, Sir Benjamin Baker, who had been interestingly reminiscent in his evidence, alarmed the lay mind by the statement that Charing Cross roof was safer, so far as rusting and stress was concerned, than half the liners that cross the Atlantic. It is indeed tolerably certain, although the roof is to be displaced by a modern structure, that the old roof is being taken down rather in deference to popular prejudice, than to any real fear that the roof itself is not safe.

An interesting witness was Sir John Wolfe Barry, who was a pupil assistant to Sir John Hawkshaw in the erection of the roof, and who remembers the testing of the principals at the works of the manufacturer, a test which would include the testing of the tie rods. Sir John agrees that the flaw could only have been discovered by laboratory experiments, and he does not think the rod had deteriorated through rust at all. He also had something to say upon the harm that must arise from overtesting materials. It appears that a thorough examination of the Charing Cross roof was made in December, 1902, when the report was that the principals were in very good condition and that the other ironwork of the roof was in good repair and that its safety was in no way threatened. It is not surprising that the jury came to the conclusion that the occurrence is within the category of accidents, and they quite rightly on the evidence before them exonerated the railway company and its officials from any blame in the matter.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.
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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

A Bill has been introduced into the United States Congress providing for a 14 ft. navigable water-way between Chicago and the Gulf of Mexico.

Successful experiments are reported on the Great Western Railway with the Leitner-Lucas system of lighting railway carriages.

Mr. Chas. M. Schwab says he is going to make the Bethlehem Steel Plant the largest, the most modern, the best equipped, and the most highly specialised in the world.

An order for the motors and control equipments for ten additional trains for the District Railway has been placed with the British Thomson-Houston Company.

The Post Office has obtained a site for a power station for its lighting and other equipment on the south side of the river near Blackfriars Bridge, but it is stated that the tenders for the generating plant and other equipment of the station have not yet been let.

The German steel trust has just issued an interesting report relating to its operations during the first year of its existence. The report deals with a period of thirteen months ended March 31st, 1905, during which the trust delivered to customers 4,994,334 tons of partly manufactured steel joists, and other shapes and railway material. Of the total sales the trust exported 28 per cent., while an average of 72 per cent. was disposed of in the home market.

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Award of Medals, etc.

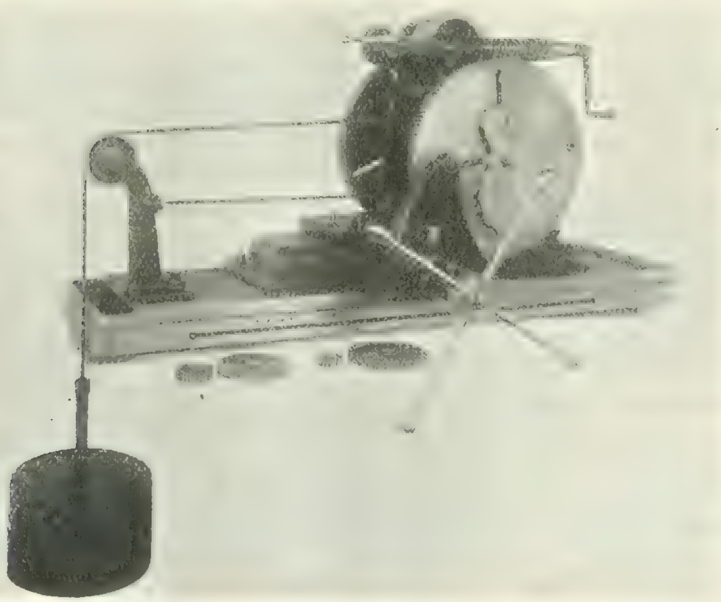
At a recent meeting of the Chemical ,Metallurgical and Mining Society of South Africa, the president (Mr. W. Cullen) said it was his pleasant duty to present the medals and diplomas to the gentlemen who had been successful in gaining them during Mr. Pearce's year of office 1903-4. Medals and diplomas were handed to the following gentlemen: Mr. J. Higham for his paper on "An Automatic Pulp Sampler"; Mr. Gerard W. Williams for his paper on "The Determination of Constants in Working Cyanide Solutions"; Mr. E. J. Laschinger for his paper on "The Decantation Process of Slimes Treatment", and a diploma to Mr. E. H. Croghan for his paper on "The Analysis of Some Witwatersrand Soils." Each award includes a prize of £50. Before concluding this pleasant little function, the Chairman added that the medals and diplomas were designed by their friend Mr. E. J. Laschinger, and he would like to accord a very hearty vote of thanks on behalf of the Society to him; also to their good friend at home, Dr. Kirke Rose, for his kindness in seeing to the striking of these medals. He announced that the adjudicators will not proceed to adjudicate on future papers until the discussion on them has been concluded.

Obituary.

We regret to announce the death at the early age of thirty-six of Mr. Henry John Young jun., eldest son of Mr. H. Young, of Messrs. H. Young and Co., Nine Elms with whom he served his apprenticeship and on whose staff he has since been occupied in the design and execution of constructional engineering work. In this some of the most important buildings in London were included. At the time of his death he was engaged as consulting engineer for the new Piccadilly Hotel buildings now in progress and a distinguished professional career seemed to lie before him. He leaves a widow and three children. Being a past-chairman of the Junior Institution of Engineers, a number of the members were present at the funeral, bearing testimony to the esteem in which he was held. To perpetuate his memory a fund has been opened with the object of placing a bronze medallion portrait in the reading room of the Institution.

"Igranic" Rheostat.

The Sturtevant Engineering Company, Ltd., 147, Queen Victoria Street, have handed over the entire control of the electrical side of their business to the Adams Manufacturing Company, Ltd., of the same address. Mr. A. H. Adams, as Director of the Sturtevant Engineering Company, Ltd., has for some years devoted a great deal of his time to the development of that branch of the Sturtevant Company's business connected with the sale of motor-controlling apparatus. The rapid growth of this business called for increased manufacturing facilities, and the Adams Manufacturing Company, Ltd., has been formed expressly for the purpose of manufacturing and selling "Igranic" motor-controlling gear and the "Adams-Hewitt" petrol motor cars. Up-to-date works have been built at Bedford, a large portion of which will be specially laid out and used exclusively for the manufacture of "Igranic" Rheostats. The personnel of the business will remain exactly as heretofore.



24 IN. FACE CAMS MILLING ATTACHMENT BY THE CINCINNATI MILLING MACHINE COMPANY. (*See page* 80.)

The Royal Mail Steam Packet Company has acquired the whole of the interest of the Pacific Steam Navigation Company in the Orient-Pacific Line to Australia. The service in future will be known as the Orient-Royal Mail Line.

Davidsen Tube Mills.

The form of tube mill which we illustrate below, appears to have worked very satisfactorily at the Waihi Gold Mine during the short period which has elapsed since its adoption.

It is probably too early yet to make an authoritative statement as to the actual results obtained at the Waihi Mine. It is, however, stated that the company is now crushing and treating fully 30 per cent. more ore by the aid of the mills, compared with the output of their 90-stamp mill prior to the acquisition of the tube mills.

In the earlier working the mills were set the task of grinding the whole of the coarse sands passed through a 25-mesh from 90 stamps. Since then the 20-mesh has been adopted and the management found that the coarser the sand the mills have to deal with the more effectively and finer they crush. The high recoveries and increased profits obtained from slimes and slimed ores by the use of the tube mill are also exemplified in the experience of the El Oro Mine, which raised its extraction 13·01 per cent.

The mill was installed by the Cyanide Plant Supply Company, to whom we are indebted for the illustration.

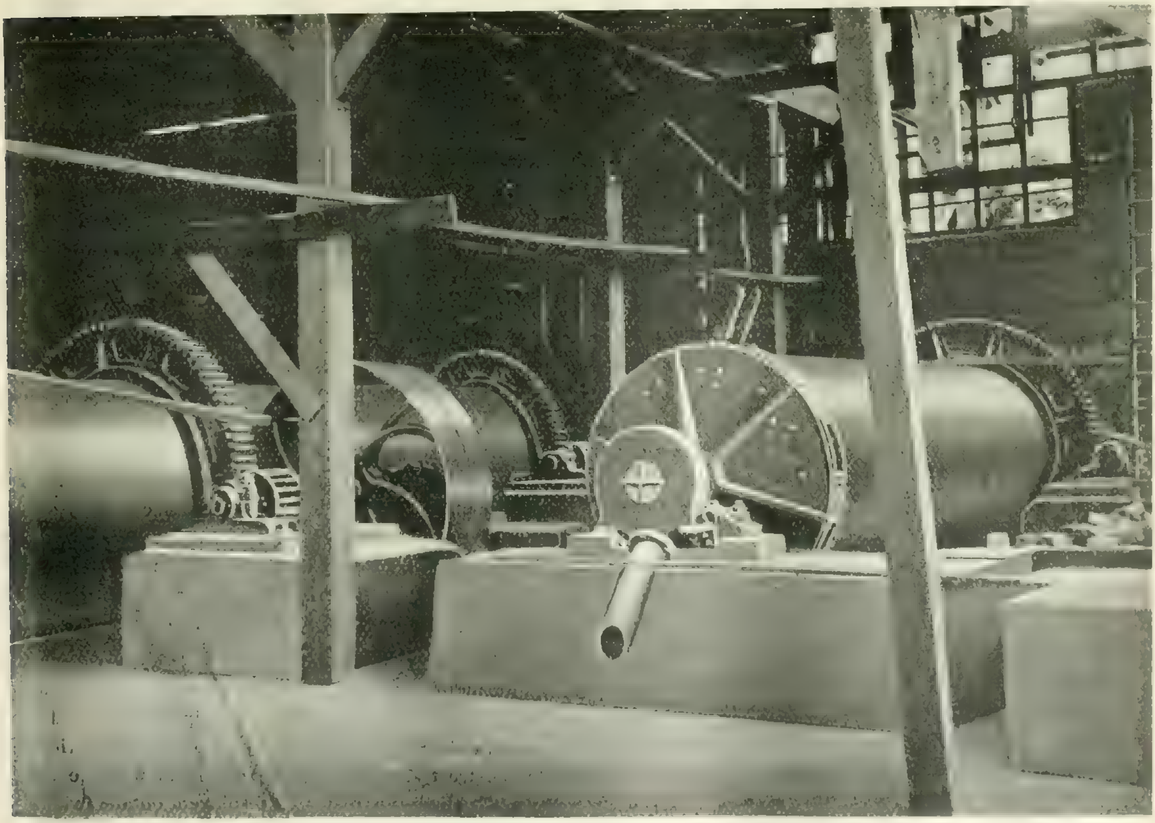
London and Port Stanley Railway.

The first electric railway to use three-phase alternating current on the other side of the Atlantic, will run between London and Port Stanley, Ontario, Canada, and it is expected to open one part of the line for service in about two months. The Ganz system is exploited in Canada by Bruce, Peebles and Co., Ltd., of Edinburgh, and in the United States, Mexico, etc., by the Railway Electric Power Company, of New York. Messrs. Bruce, Peebles and Co., Ltd., are the sole manufacturing agents for the Ganz three-phase traction patents throughout the British Empire

The Mineral Resources of Corea.

The Board of Trade have received, through the Foreign Office, from H.M. Minister at Seoul (Sir John Jordan, K.C.M.G.), a translation of the report by the Commercial Bureau of the Japanese Foreign Office on Mines and Mining in Corea.

The following extracts from this report will indicate



DAVIDSEN TUBE MILLS AT THE WAIHI GOLD MINE.

generally the mineral resources of the country, but Sir J. Jordan points out that the figures embodied in it are not in every case accurate.

The mineral output of Corea may be considered to consist practically entirely of gold, which is recovered both by placer and quartz mining. The number of places where gold is at present worked either by placer or quartz mining methods amounts to over 120. The amount produced annually is about 121,000 oz., of a value of some £450,000. Quartz gold appears most plentiful in Pyeng-An province, the Wonsan mine being the most valuable in the country. The next in importance is the Kun-san mine. Other valuable mines are the Chang-song and Tel-chon. Placer gold occupies the principal place in the products of the peninsula, and the mining districts are more widely distributed than those of the quartz mines. Of the total gold output of £450,000 the proportion of placer gold amounts to some £300,000, or 66 per cent. of the total. The principal centres of placer mining are situated in Pyeng-An province, the whole annual output of this province being about 48,000 oz., of a value of over £150,000, or one third of the total output of gold in the country.

In spite of the demand for silver in Corea, there is no native supply. There are, however, silver mines in the country. Experimental workings have been made, and it appears that there are undoubtedly silver deposits. Owing to the expense of working, however, they offer far more difficulty in working profitably than gold mines, and especially than placer gold.

Copper occurs chiefly in the north and south of the peninsula, and is rarely found in the central districts. The principal mine in the country is that of Kap-san, in Ham-Gyeng province, which has a considerable output, amounting to some 270,000 lb. of refined copper per annum.

Iron is found in Whang-Hai and other provinces, but the difficulty and expense of mining and smelting have hitherto precluded the Coreans from engaging to any great extent in this industry.

The future of the coal mining industry in Corea does not look promising ; there are, however, coal deposits in several places. Of these deposits only that at Pyeng-Yang consists of smokeless coal, all the other being bituminous, and though some of the deposits are of considerable extent, the quality is not very good.

Crystal is a famous product of Corea. It is found principally in Kyeng-ju, in North Kyeng-Sang province, and is of excellent quality. Talc of excellent quality is found at Pyeng-hai in Kang-Won province and in the neighbourhood of Yee-Chun, in Kyeng-Kei province, but it does not appear ever to have been worked.

Calendars.

A neat calendar reaches us from The Quarry, the organ of the stone, marble, slate, lime, clay and cement trades. In addition to a well-arranged calendar, showing the dates alternately in red and black, it has a list of H.M. Inspectors of Quarries.

Messrs. Wm. Firth, Ltd., iron and steel merchants, Leeds, have issued a very cheerful-looking wall calendar, a portion of their works being shown in the centre panel, Considerable space is given up to the date tablet, which is rendered in white on blue. We are incidentally reminded that the firm produces steel pit girders and props, bar iron and steel, plates and sheets, joists, channels, angles, wheels and axles, springs, bolts and nuts, galvanised corrugated sheets, pipes and tubes, rails, fishplates, bolts, spikes, chairs and sleepers, points and crossings, etc.

From the Chloride Electrical Storage Syndicate, Ltd., Clifton Junction, near Manchester, we have received a small pocket calendar with celluloid cover. This, in addition to the dates for 1906 and details of the chloride accumulators, has some wax leaves intended for the reception of postage stamps.

Messrs. W. T. Glover and Co., Ltd., Trafford Park, Manchester, are to be congratulated on the appearance of their substantial wall calendar, which shows sections in colour of their various Diatrine paper-insulated cables. A casual glance at the tear-off calendar sheets shows that a good deal of trouble has been taken to bring the text and illustrated matter well up to Messrs. Glover's usual standard. For every day there is something new, and the matter supplied has the additional charm of variety. One does not know whether to expect from day to day information about cables, quotations from classic authors, or impromptu poems, such, for instance, as one which is set down for April 17th, commencing "Mary had an electric lamp." Another excellent feature of the arrangement is that the leaves are not gummed down, so that anyone whose curiosity is stimulated may take the whole *en bloc*. At the back of this calendar are approximate rules for finding cable sections and other useful items of information.

From the same firm we have received an admirable advertisement in the shape of a pipe-cleaner, and must congratulate the originator on his poetic vein. He says, "We trust that (with pipe free from nicotine stings) you'll notice the message displayed on the wings"—which message, needless to say, is summed up in the words "Glover's cables."

THE POWER PLANT OF THE SCOTTISH CENTRAL ELECTRIC POWER COMPANY.

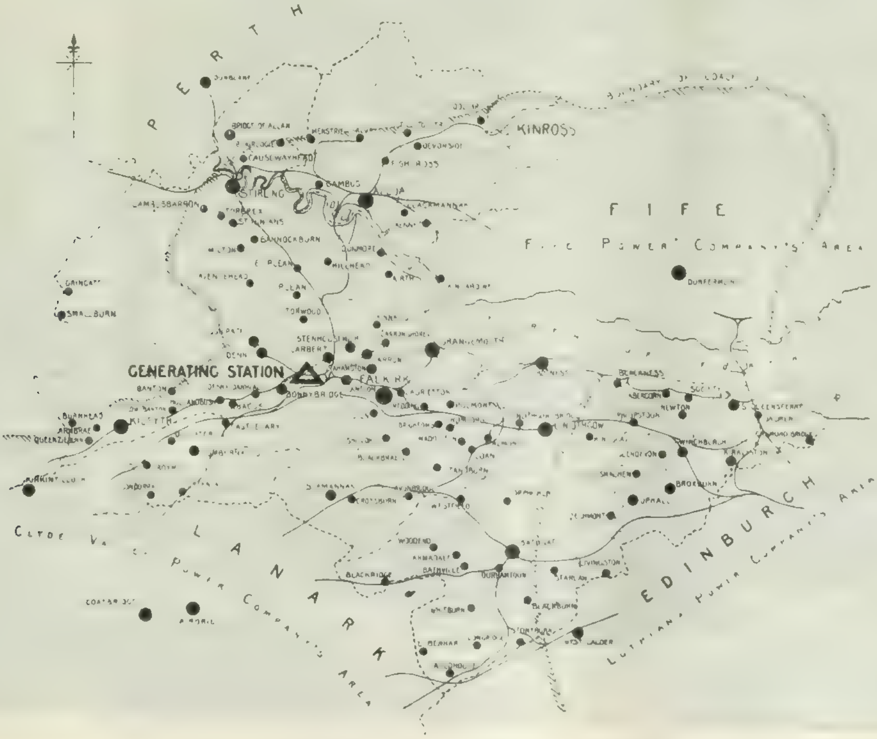
ONE of the latest companies to undertake the supply of electrical energy in bulk or otherwise for power and other purposes is the Scottish Central Electric Power Company. Its powers, obtained in 1903, extend over an area of about 400 square miles. From the accompanying map it will be seen that it includes the principal Scottish mineral oil works and the most important manufacturing and coal-producing districts in the Midlands of Scotland.

The Bonnybridge Generating Station lies half-way between Bonnybridge and Falkirk. It is now in full operation supplying current to the Tramway Sub-Station No. 1, for working the Falkirk and District Tramways, and to other consumers.

In addition to the generating station and the sub-station which the Company have already built, they have in hand the erection of other sub-stations, and the laying of an elaborate system of mains to embrace the various manufacturing centres and coal fields around the power station. The supply will be on the alternating current system, supplying two-phase current at 50 periods and 440 volts pressure. By the courtesy of the company we are enabled to publish a description of the salient features of the plant.

The generating station is constructed of red brick obtained in the district. The engine-room measures 67 ft. long by 46 ft. wide. On the south side are the switchboard gallery and office, which have an inside measurement of 67 ft. long by 13 ft. in depth.

The boiler-house is situated on the north side of the engine-room, and measures 77 ft. by 63 ft. wide. The building contains space for 3,000 k.w. of plant besides the auxiliary machinery. It adjoins the Larbert and Denny Branch of the Caledonian Railway off which ample siding accommodation has been obtained.



AREA OF THE SCOTTISH CENTRAL POWER COMPANY.

ENGINE ROOM.

The main generating plant at present installed consists of two three-crank compound engines and two of the two-crank compound type, all of Messrs. Willans and Robinson's manufacture.

Each of the main engines is direct coupled to [illegible] Bruce Peebles alternators of standard type with rotating field giving two-phase current at [illegible] periods and a pressure of [illegible] volts.

The two exciter sets situated on the north side of the engine room, [illegible] of [illegible] k.w. each, also consist of Willans engines coupled direct to Bruce Peebles shunt wound dynamos generating continuous current at a pressure of [illegible] volts. From these the current used for the excitation of the alternator field is obtained and in addition all the current necessary for driving the various auxiliary motors and the lighting of the station.

Adjoining the present plant active preparations are going on for installing additional machines. This part of the engine room will consist of two floors. The basement will contain the condensers, air pumps, etc.

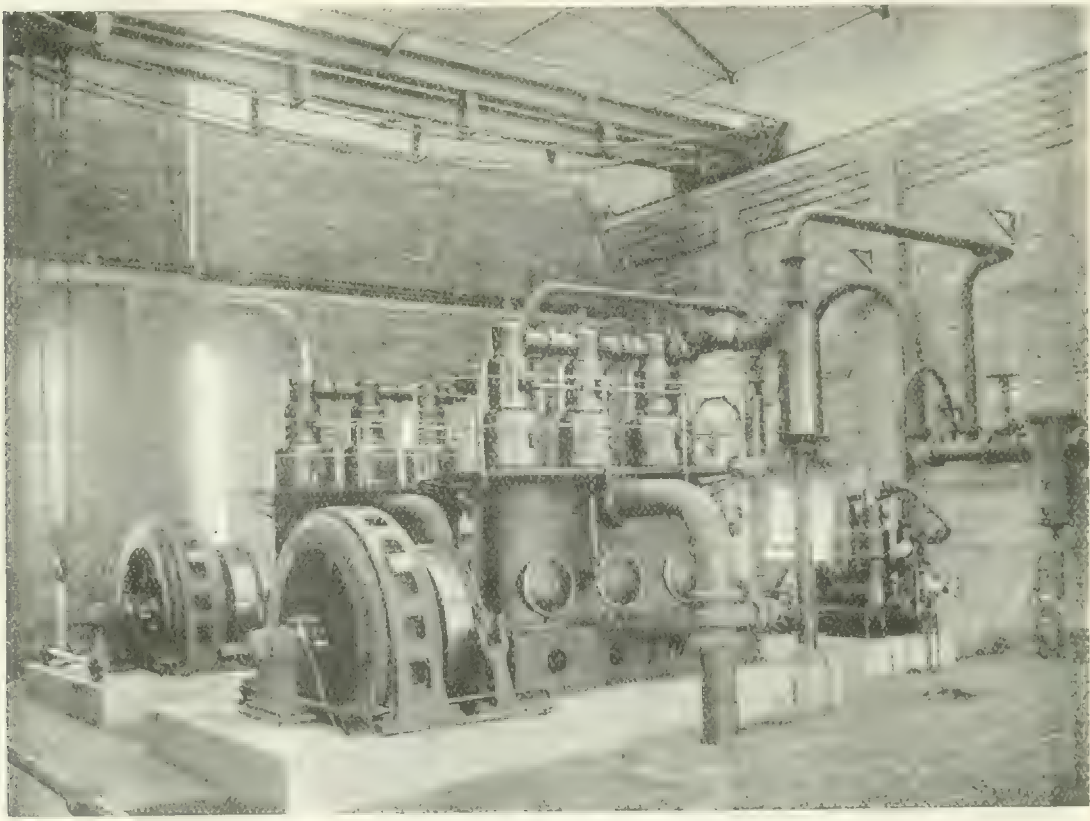
The extension plant will consist of two [illegible] k.w. Parson Willans steam turbines coupled direct to Messrs. Bruce Peebles alternators and [illegible] k.w. Willans-Peebles direct current set. Each of the turbo-alternator sets will exhaust into its own condenser of the Storey type placed directly below in the basement.

The circulating water for the condensers will be taken from and returned to the Bonny Water by means of motor-driven centrifugal pumps placed in the pump house built on the river bank.

SWITCH GEAR.

The switching apparatus supplied by Messrs. [illegible] of Manchester for controlling the whole of the plant is situated at the south side of the engine room. The main switchboard consists of two generator panels, each of which has its exciting panel below, a synchronising panel and three outgoing feeder panels.

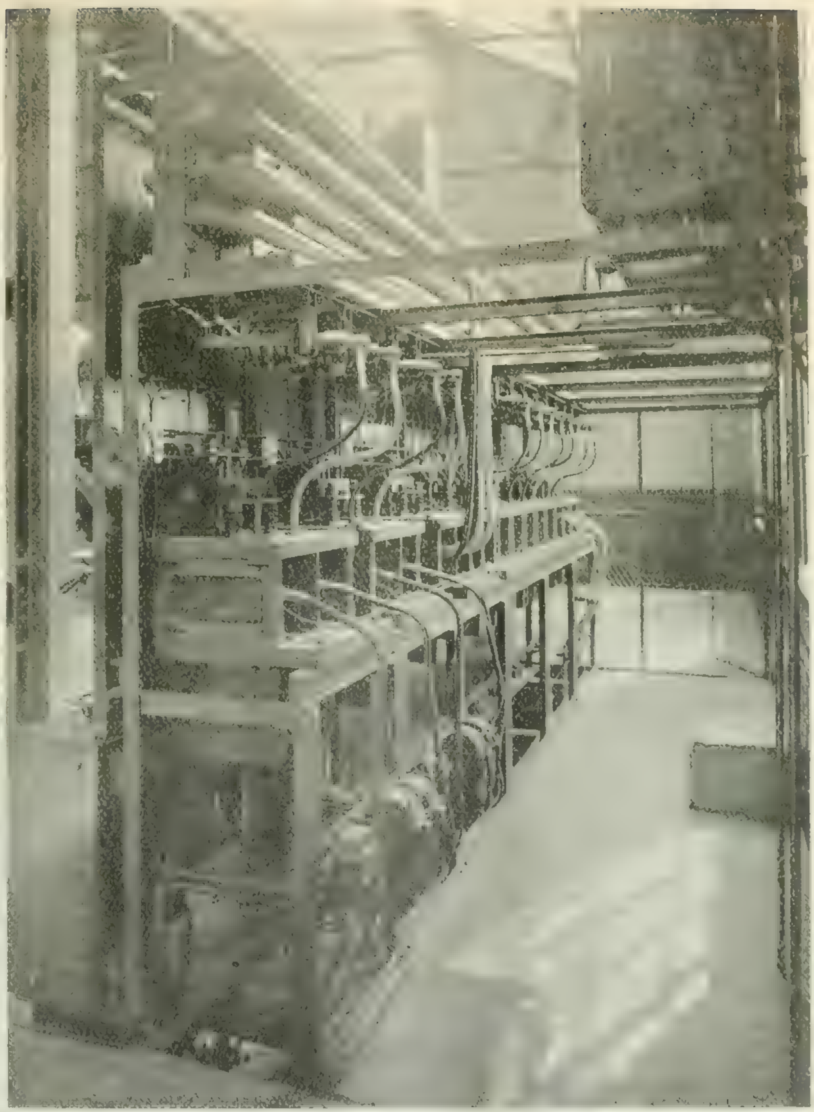
As will be seen in the view showing the back of the board, two sets of bus-bars are provided, which with the connections of different polarity are separated by [illegible] partitions. Each [illegible] feeder



INTERIOR OF ENGINE-ROOM.

panel consists of three panels, two of which are in use while the third acts as a spare. To this spare panel the spare cable in the feeder network is so connected that it can at a moment's notice be plugged to the desired bus-bar and switched into service if either one of the other feeders breaks down. A feature of the board is that above the circuit-breakers are fixed coloured lamps indicating whether the circuit-breakers are closed or not.

Two additional generating panels are in course of construction for extending the high tension switchboard, also a panel on the low tension board to provide for the extension plant now going in.



BACK OF HIGH TENSION SWITCHBOARD.

THE BOILER HOUSE.

There are at present installed four Sinclair's Lancashire boilers, 30 ft. long by 8 ft. [illegible] in. inside diameter of shells, and working at [illegible] lb. per square inch, each evaporating [illegible] lb. of water per hour. A superheater is provided for each boiler, and built into a special chamber provided at the back end of the boilers. In the main flue are placed two Green's economisers with electric motor-driven scrapers and the usual accessories.

Provision has been made for two additional boilers which are under construction. When these are placed in position the space in the boiler house will be fully occupied.

For boiler feed purposes there are two Hall's feed pumps, each capable of delivering 3000 gallons of water per hour to the boilers. In addition, there is also a live steam injector as an emergency feed, which is able to deliver 3000 gallons per hour against the boiler pressure.

By the arrangement of feed piping water can be drawn either from the overhead feed tanks or from the reservoir and delivered either direct to the boilers or first through the economisers.

Overhead tanks are provided in which are placed coils through which circulate the exhaust steam from the pumps to heat up the feed water. The tanks are supplied with water from the [illegible] mains of the Falkirk and Larbert Water Trust from the reservoir by means of the [illegible] centrifugal pump in the [illegible] of another centrifugal pump from the river. Instead of building a high brick chimney to obtain the necessary draught a short steel stack has been erected, having an internal diameter of 7 ft. and a height from the floor line of [illegible] ft. It is lined for a part of its length by a 4½-in. firebrick lining. An induced draught plant has been installed and connected to the chimney near its base. This system gives a better draught, with more perfect regulation, thereby largely obviating the smoke nuisance. The steaming capacity of the boilers can be considerably increased above their normal working capacity, and it also allows of a much cheaper kind of fuel being used, and is moreover cheaper in first construction.

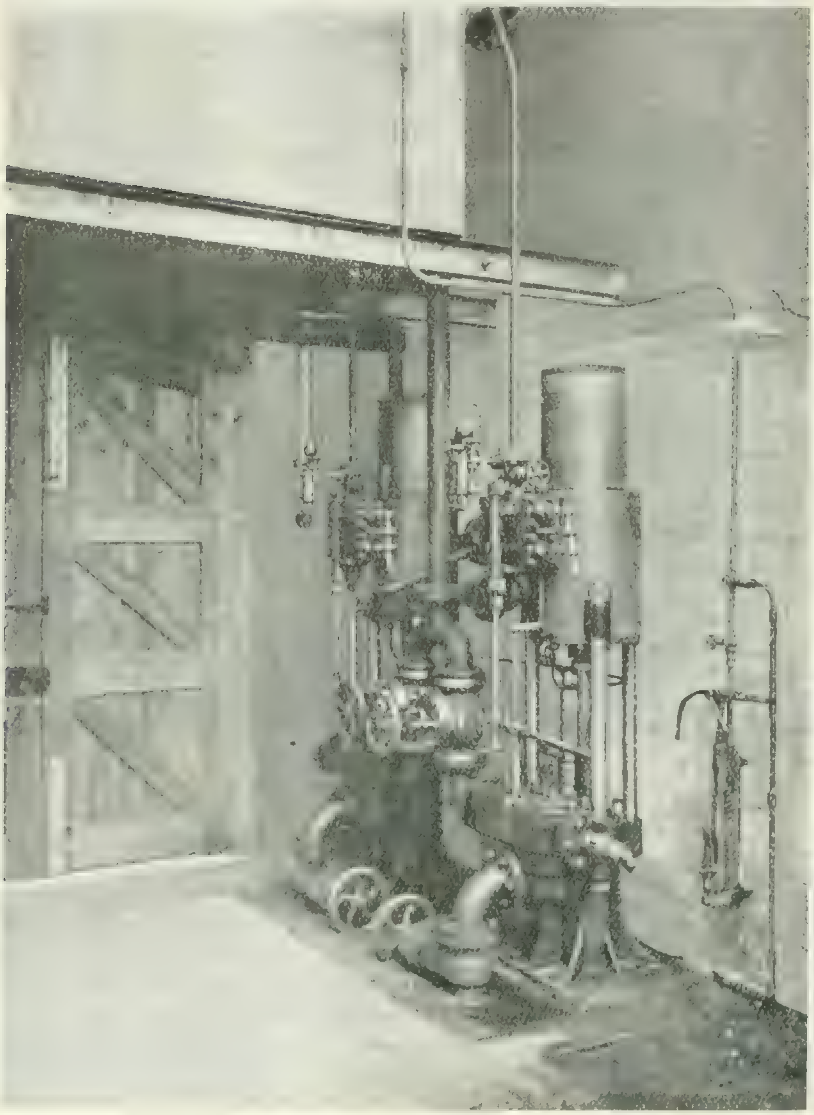
The induced draught plant consists of a motor-driven Sturtevants' exhausting fan, which, owing to its close proximity to the chimney, is provided with large water-jacketed bearings, through which water is constantly circulating.

The steam range which has been carried out by Messrs. Aiton and Co. is on the ring principle, so that the engines can be supplied from either end in the event of any repair being required to the steam range. The system is also abundantly provided with valves for quickly shutting off any defective part and for changing over from one generating set to another. The steam pipes are of mild steel, lap-welded with flanges of the same material screwed on, and then riveted over. The whole of the pipes and boilers are being covered with No. asbestos by Messrs. A. Haacke and Co.

Coal is brought to the station by a siding off the Denny branch of the Caledonian Railway. When the trucks arrive opposite the boiler house the coals are dumped on to the firing floor through large openings in the wall. It is intended to further elaborate this system by the addition of large coaling bins, whereby the coal falls on to the stokehold floor by gravity.

The reservoir outside the building acts as a reserve, and is filled either from the mains of the Falkirk and Larbert District Water Trust or from the Bonny Water by means of a motor-driven centrifugal pump fixed in the pump-house.

The pump-house accommodates two large motor-



HALL'S FEED PUMPS.

driven centrifugal pumps for circulating the water through the condensers. They are each capable of delivering 80,000 gallons per hour against a head of 60 ft. The house also shelters the small motor-driven centrifugal pump for supplying water to the reservoir, or to the feed tanks in the boiler house, as the case may be. The pumps are of Messrs. Drysdale's manufacture, and coupled direct to Messrs. Bruce Peebles' motors.

DISTRIBUTION.

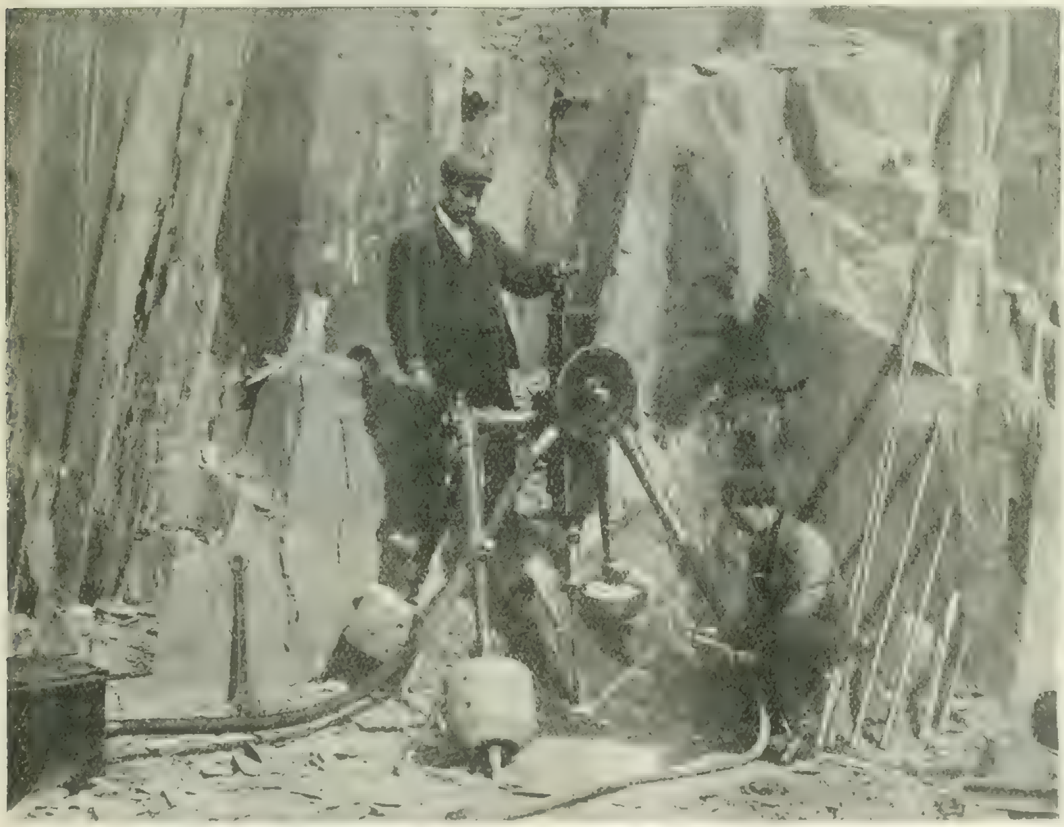
The 3,000-volt feeder cables which are being manufactured and laid by Messrs. Callender's Cable Construction Company are paper-insulated and lead-covered. They are further protected by two layers of steel tape. The cables are all laid in duplicate, so that in case of accident to any one of the cables the spare cable can be immediately connected and the damaged cable taken in hand for repairs.

It is the Company's intention as soon as the present cables have been put in operation to extend their system as rapidly as possible to other districts lying further afield.

Messrs. Bramwell and Harris of Westminster are the Consulting Engineers to the Power Company. The whole of the plans have been prepared and the works carried out under the supervision of Mr. H. Graham Harris.

The major portion of the machinery and plant for the generating station and sub-station has been put in and erected by Messrs. Bruce Peebles in conjunction with their various sub-contractors. The whole of the buildings described have been built by the local building firm, Messrs. J. and J. P. M'Lachlan of Stenhousemuir.

In the course of a dissertation on the numerous applications of electric power, the company claim that the economy of the electric drill over the compressed air variety is overwhelming, 1 h.p. in the former case doing as much useful work as 10 h.p. in the latter. From 420 to 450 blows can be given per minute, and holes up to 6 ft. or 7 ft. in depth can be easily made. The General Manager of the Company is Mr. E. C. Churchward. The Secretary is Mr. James Walker, C.A.

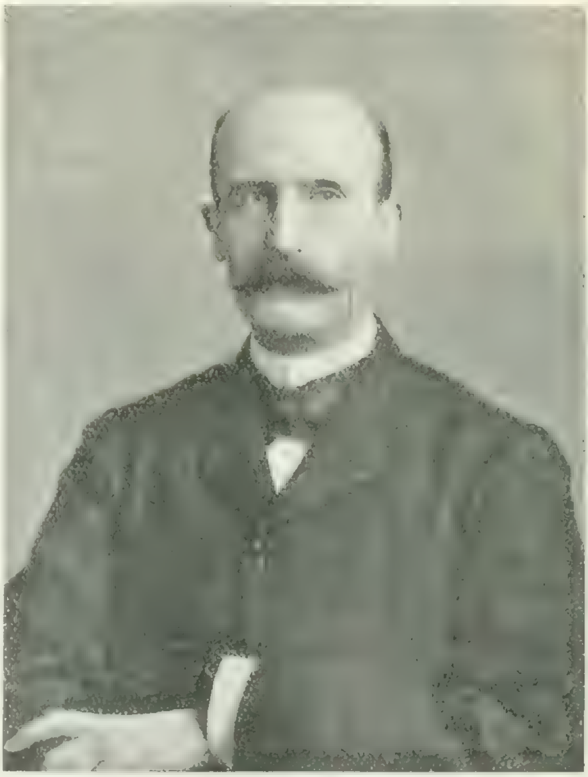


PORTABLE ROCK DRILL, DRIVEN BY MOTOR AND FLEXIBLE SHAFT.

OUR WEEKLY BIOGRAPHY.

HAY FREDERICK DONALDSON, M.Inst.C.E., M.I.Mech.E., Hon.F.R.I.B.A.

MR. H. F. DONALDSON, Chief Superintendent of the Royal Ordnance Factories, was born at Sydney, in 1856, being the second son of the late Sir Stuart Alexander Donaldson, who was knighted for services rendered as first Prime Minister of New South Wales, Australia. Educated at Eton, he passed from there to the University of Edinburgh, where, having resolved to adopt the engineering profession, he studied mathematics, chemistry, metallurgy, and applied mechanics. He next became an apprentice and pupil of Mr. F. W. Webb at the London and North-Western Railway Locomotive Works, Crewe. Upon the completion of his indentures, in 1877, he matriculated at Trinity College, Cambridge, and spent the following year there in the study of applied mechanics under Professor Stuart.



Photo, Elliott and Fry.

H. F. DONALDSON, M.INST.C.E., M.I.MECH.E., HON.F.R.I.B.A.

After leaving Cambridge Mr. Donaldson went to Germany to study the language of that country. He then went to Switzerland, and entered the Zurich Polytechnic, where for another year engineering studies received his attention. For some months after his return to England, he worked in the drawing office of Messrs. Appleby, then at Greenwich. Later on, in the same year, he went for a tour of study through India.

On his return he was engaged as assistant to Mr. J. Kincaid, M.Inst.C.E., and was entrusted with the duties of resident engineer in charge of the construction of the Burnley tramways, which were completed and inaugurated under his direction. Mr. Donaldson was then appointed Assistant Engineer and subsequently promoted to District and Executive engineer under Mr. E. Sawyer, M.Inst.C.E., for the West of India Portuguese Guaranteed Railway Company at Morninguo. He remained there for six years, engaged in laying out and constructing both harbour and railway works. The line was completed shortly after his return to England, but the plans of the harbour have not yet been carried out in their entirety, though the work already accomplished is evidence of sound and efficient design and construction.

Mr. Donaldson was employed by the late Mr. Thomas Walker as one of his engineers on the construction of the Manchester Ship Canal. He was closely occupied by this work, and after Mr. Walker's death, was, with the rest of Mr. Walker's staff, retained up to a period of about three years. Before the canal was completed he was invited by a body of gentlemen interested in canal construction and by the executors of the late Mr. Walker to go out and report upon the Nicaragua Canal scheme. Mr. Donaldson accepted the offer, and finally submitted his report. While in Nicaragua he was requested to go further afield and report on a railway proposal for Costa Rica, which work he also undertook.

Returning to England in 1891, the results of his investigations kept him busy privately for about eighteen months. In 1893 he was appointed chief engineer to the London and India Docks Joint Committee, a position he occupied for five years. On January 1st, 1898, he took up the position of Deputy-Director of the Royal Ordnance Factories under the late Sir William Anderson, the then Director-General. The following year Colonel E. Bainbridge was appointed as Chief Superintendent of Ordnance Factories (the title of Director-General lapsing on the death of Sir William Anderson), and Mr. Donaldson was entitled chief mechanical engineer. In 1903 Colonel (now Sir E.) Bainbridge retired, and Mr. Donaldson was appointed to succeed him as Chief Superintendent, which office he continues to hold. Keenly interested in all matters of benefit for the education of young engineers, he has presided over a committee to advise upon the qualification for managerial and foremen's positions in the Royal Ordnance Factories, and the recommendations made by that committee are now being carried out with promising results for the future. The results are likely to be of increasing interest, as the prospects become better known, for young men suitably qualified can get their workshop training with prospects of future work on terms far superior to those generally offered. The starting qualifications are, however, necessarily high.

Mr. Donaldson is a Member of Council of the National Physical Laboratory and a *pro tem.* Member of Council of the Institution of Mechanical Engineers, having been nominated by the Council to temporarily fill a vacancy caused by the decease of one of the members. He is chairman of the sub-committee on Screw-threads and Limit Gauges, under the Engineering Standards Committee, and was recently appointed a Governor of the East London College.

THE MINERAL PRODUCTION OF TASMANIA.

The following table, compiled by the Government geologist and forwarded to the Commercial Intelligence Branch of the Board of Trade by Mr. E. A. Nowell, clerk of the Executive and Legislative Council of Tasmania, shows, as far as can be ascertained, the quantities and values of metals and minerals produced in Tasmania in the quarters ending 31st March and 30th June, 1905:—

		March Quarter, 1905		June Quarter, 1905	
		Quantity	Value	Quantity	Value
			£		£
Gold * (fine), with ...	Ozs.	16,170	68,6[illegible]	17,[illegible]46	7[illegible]
Silver and lead ore † raised ...	Tons	17,70[illegible]	54,896	14,440	53,031
Blister copper † produced	,,	1,307	152,77[illegible]	[illegible]	167,[illegible]
Copper ore and matte copper produced	,,	21[illegible]	11,903	2[illegible]9	13,865
Tin ore	,,	92[illegible]	82,002	711	61,882
Iron ore	,,	1,600	7[illegible]	1,[illegible]00	[illegible]
Coal	,,	13,383	11,2[illegible]	12,47[illegible]	10,51[illegible]
Wolfram ore ...	,,	3	[illegible]	[illegible]	480
Bismuth ore ...	Cwts	15	200	—	
Total value ...		—	383,364	—	373,373

* Including gold contained in blister copper and silver lead bullion.
† Value of gold contents deducted.

According to the Railway News, the building of the new carriage works of the Brighton Railway Company at Lancing is about to be commenced, the space vacated at Brighton being used for extensions of the locomotive works.

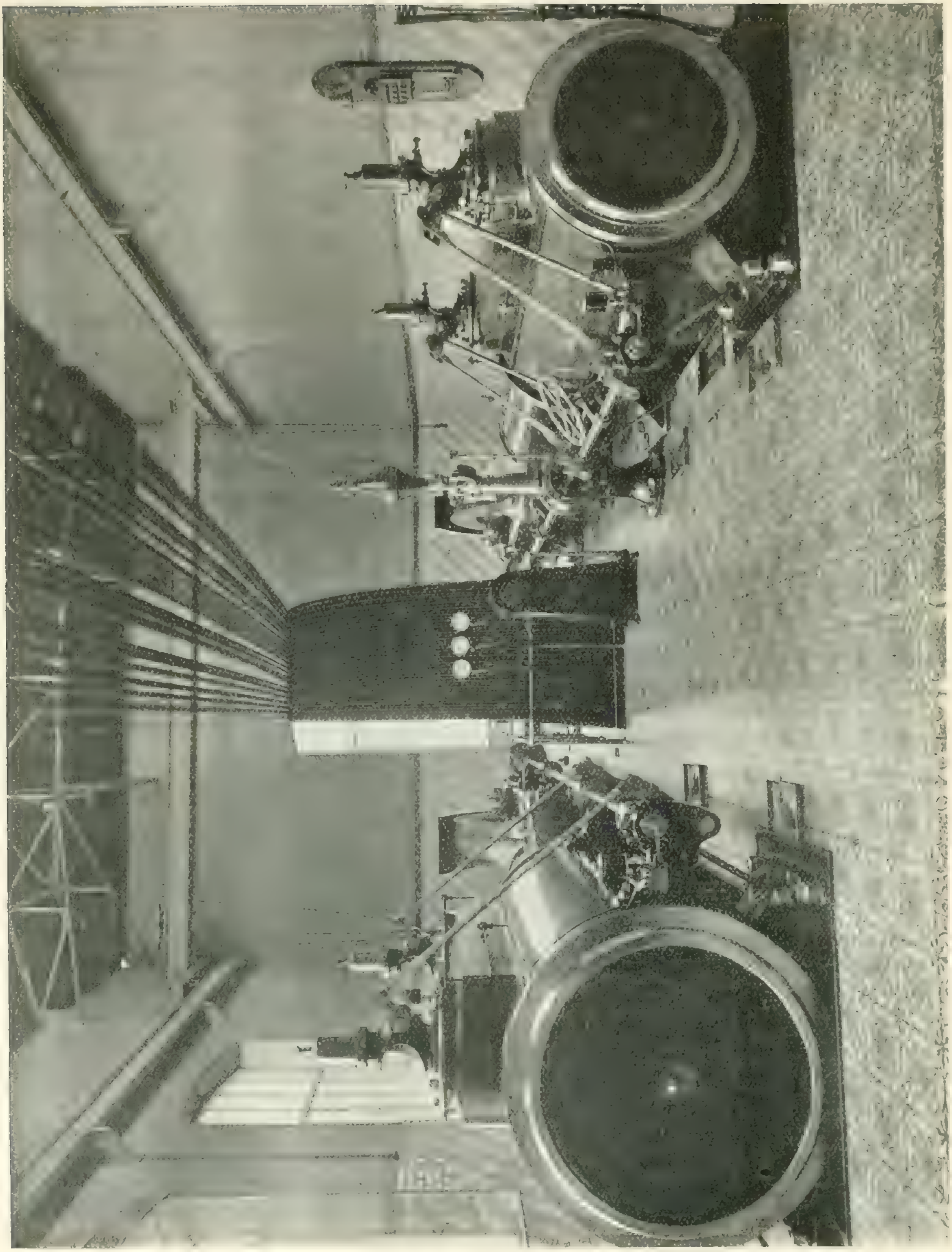


FIG. 1. TWIN CYLINDER COMPOUND CARELS ENGINE OF 1,000 H.P., WITH ROPE DRIVING, AT A COTTON MILL AT ROUEN.

THE ENGINE WORKS OF MESSRS. CARELS FRÈRES.

By P. R. Allen, A.M.Inst.C.E., M.I.Mech.E.

THE slow or moderate speed horizontal engine has always been regarded as a type eminently suitable for driving cotton mills, weaving sheds, flour mills, and for various similar operations where the economical production of power is the predominant factor in the cost of manufacture, and where regularity of turning and the certainty of continuous operation are essential features. Such engines have been built by some of the eminent firms in Lancashire and Yorkshire for the last century, and may at the present day be found driving textile machinery both in Moscow and Bombay, as well as in Oldham and Bolton.

The writer recently had an opportunity of seeing the manufacture of these and other engines at the works of Messrs. Carels Frères, at Ghent. The firm have for many years built locomotives and have recently embarked upon the building of the "Diesel" oil engine, but they are principally known as builders of high-class horizontal steam engines.

STANDARD TYPES.

These engines are built in standard types, as single engines with one cylinder, or with twin cylinders, one on each side of the flywheel, or as compound engines with the cylinders arranged tandem, or with twin cylinders acting

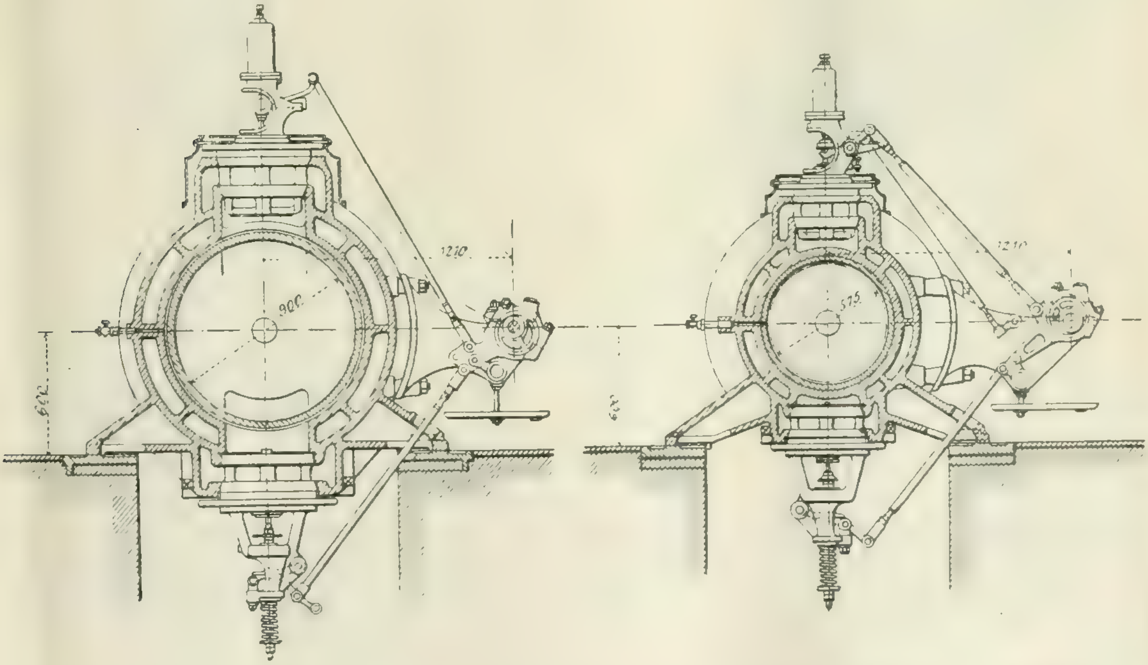


FIG. 2. CROSS SECTIONS LOW-PRESSURE AND HIGH-PRESSURE CYLINDERS OF TANDEM ENGINE BY MESSRS. CARELS FRÈRES

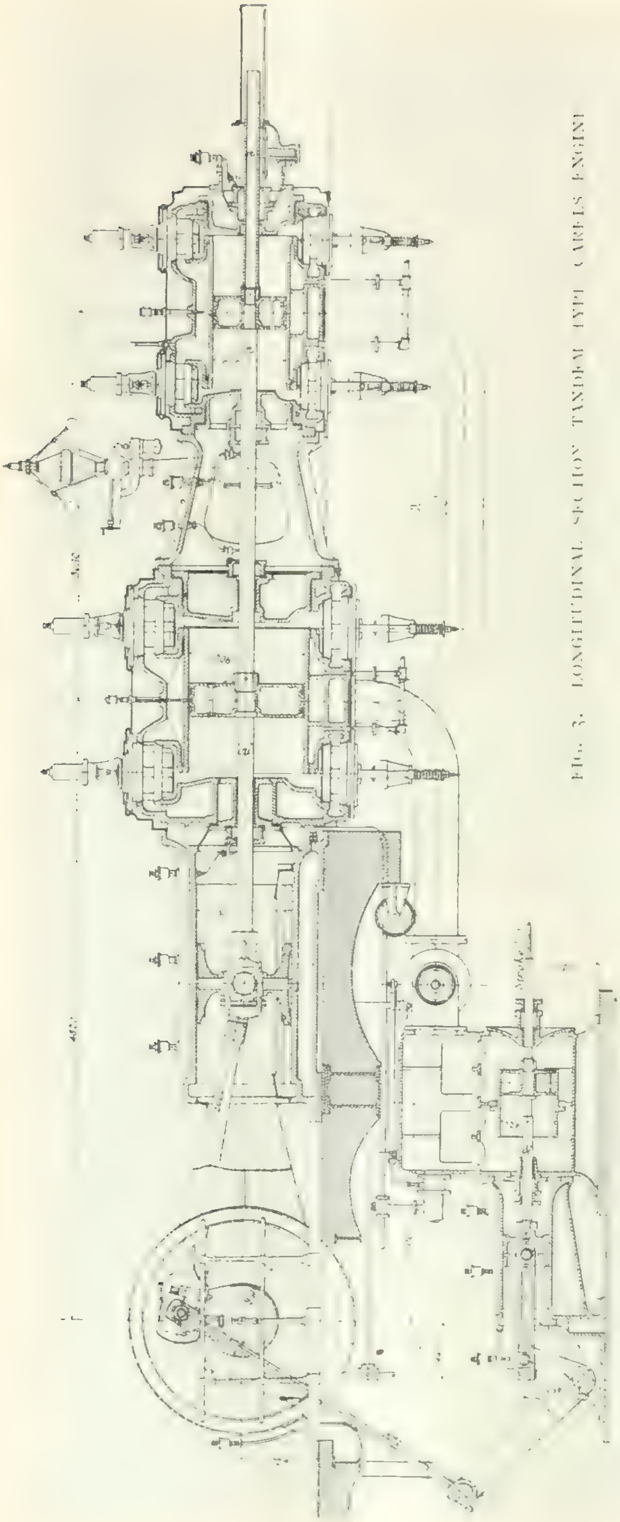


FIG. 3. LONGITUDINAL SECTION TANDEM TYPE CARELS ENGINE

on two cranks placed at right angles, while the triple-expansion engines are built with high-pressure and intermediate cylinders, placed tandem on one side of the flywheel, and the low pressure cylinder on the other side. In some instances two low-pressure cylinders are used and where this is done each crank has two cylinders placed behind it, arranged in tandem.

Ordinary saturated steam may be used with these engines, but with slight modifications of the design superheated steam at high temperatures, and some figures as to the economy derived from this practice will be quoted. For mill-driving, the engines are built for a normal speed, while for coupling direct to dynamos the speed is increased.

Fig. 1 shows a twin-cylinder compound engine of 1,000 h.p., with rope driving at a cotton mill in Rouen, and this is reproduced from a photograph taken while the engine was running. Fig. 4 shows another compound, but with cylinders arranged tandem, coupled direct to a dynamo. This is working at the Rouen tramways and lighting station.

These illustrations show the appearance of the general design, and the simplicity of the valve gear and governing arrangements. Figs. 2 and 3 are sections of one of the tandem type of engines, adapted for coupling direct to a dynamo. Fig. 3 being a longitudinal section, and fig. 2 cross section to the low-pressure and high-pressure cylinders respectively.

Double beat valves are used which are shown in detail in figs. 5 and 6. It will be seen from the sectional views of the engine that the valves are placed in the body of the cylinder itself, the port passages being formed by the recesses in the head. This arrangement has the considerable practical advantage that it enables the cylinder covers to be taken off and replaced without in any way having to interfere with the valve gear. The cylinders are steam jacketed, the liners being of a very good quality of cast iron, having a tensile strength of not less than 14 tons per square inch, and a compressive strength of 58 tons per square inch. The trip motion releasing the admission valve is controlled by the governor in the usual way, but the mechanism is of an exceedingly simple nature. Usually only the high-pressure cylinders are fitted with variable expansion gear, the valves for the low-pressure and intermediate being worked direct by the eccentrics.

Where tail rods are employed to take a portion of the weight of the piston either the ordinary slipper guide is used or an adjustable pad, on which the tail rod works, is placed outside the stuffing box.

The general finish of the engines is uniform with the style adopted now by nearly all high-class Continental engine builders, that is to say the engine is painted a very dark blue-black, almost black, very sparingly relieved by polished work, the parts that are bright being the parts such as the valve rods, governor, gear, etc., which would have to be turned and polished in the ordinary course of events.

The condenser, where a condenser is employed, is usually placed directly under the engine, as shown in fig. 3, the air pump being worked by a connecting rod from the crank.

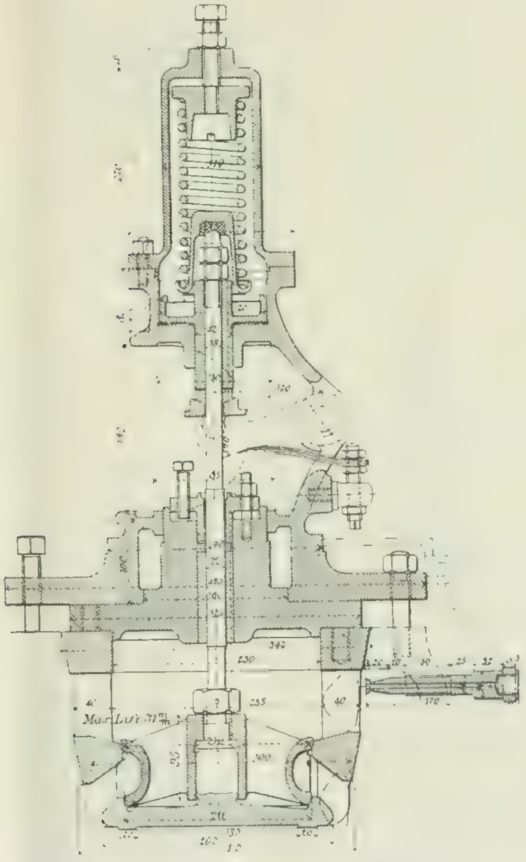


FIG. 5. DOUBLE BEAT TYPE VALVES FITTED TO CARELS ENGINE.

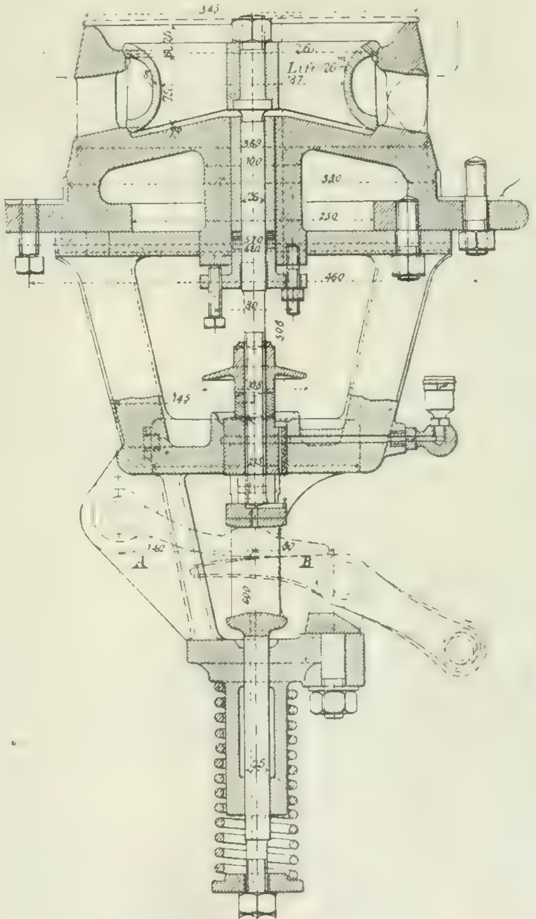


FIG. 6. ANOTHER VIEW OF DOUBLE BEAT VALVES.

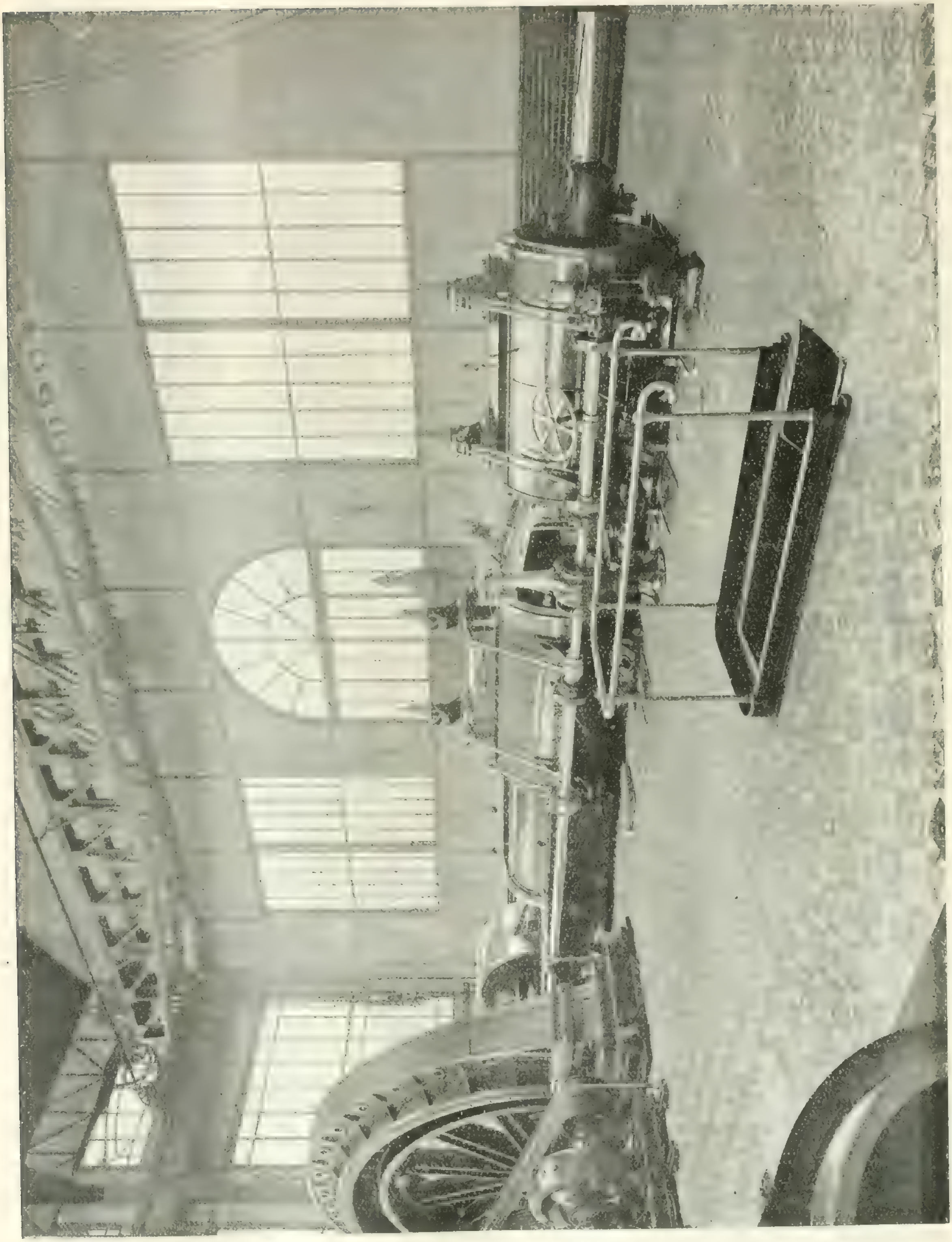


FIG. 4. COMPOUND CARELS ENGINE COUPLED DIRECT TO A DYNAMO, WORKING AT ROUEN TRAMWAYS AND LIGHTING STATION.

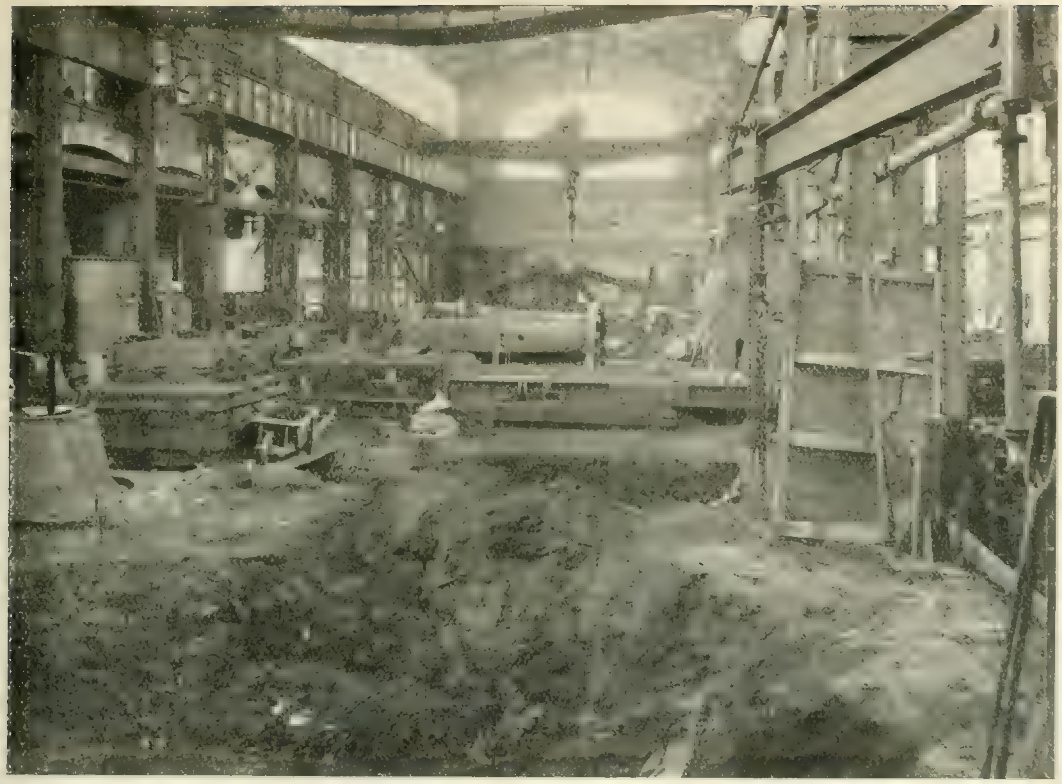


FIG. 7. VIEW OF FOUNDRY AT WORKS OF CARELS FRERES, GHENT.

THE FOUNDRY.

In visiting an engine works, one naturally begins at the foundry. All the castings turned out are of a very high quality, both as to the properties of the metal and as regards cleanness of castings. Sample pieces of every day's work are taken, and at once tested, the results obtained from each test being carefully tabulated and recorded in a log book, so that any variation in the pig or in the mixture is noticeable in a few hours' time.

The general arrangement of the heavy foundry is illustrated in fig. 7.

MACHINE SHOP.

There is not much to remark in the machine shop proper, except that it is well equipped with modern tools by good makers. As is now usually the case, piston rods and the like are finished on grinding machines, of which there are several in the works, some being by American makers and others by Germans. A considerable amount of attention seems to be paid to the fitting of the piston rings, both on their faces and on their sides.

In the erecting shop, Messrs. Carels adopt the rather unusual plan of putting the engines together twice, in the first instance the parts as they come from the tools are assembled and put together just as they are, the engine being erected for the first time as it were in the rough. When it is ascertained that all the working parts are properly fitted, it is taken down, and all the parts are finished and polished.

SYSTEM OF ERECTING, GAUGING, AND INSPECTING.

Everything is gauged again, and the engine is erected a second time, so that when it is finished in the erecting shop it is exactly in the same state as it will be when it is erected at its destination.

(To be continued.)

SHIPBUILDING NOTES.

A FURTHER selection of the annual returns of British shipbuilding firms appears below. The statistics of most of the leading firms show an increased output on the previous twelve months, while the outlook for the present year is generally encouraging. A number of the yards have already contracted for sufficient work to keep them busy during 1906 and a few firms can look still further ahead. The total output for the United Kingdom has been variously estimated, although it may be safely taken to approximate well over 1,824,000 tons—the largest aggregate on record. On the Tyne an increase of about 78,096 tons is recorded. The first place in the summary of local returns has been secured by Messrs. Swan, Hunter, and Wigham Richardson, Ltd., with an aggregate of 82,727 tons, or an increase over the preceding year of 9,135 tons. Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., come second with 67,652 tons, indicating a substantial increase; while the third position falls to the Northumberland Shipbuilding Company. Messrs. R. Stephenson and Co., of Hebburn, have launched about four times as much as their previous output, the firm's tonnage having risen from 8,648 to 32,750. On the Wear there has been a net increase in the tonnage of 95,000 tons. As we have already pointed out, the shipbuilding blue ribbon has been secured by Messrs. Doxford and Sons. Compared with last year the firm have an increase of 33,582 tons to their credit, and at present they have six vessels on the stocks. Second position on this river falls to Messrs. J. L. Thompson and Son, Ltd., whose returns for thirteen vessels show a gross tonnage of 48,009. The largest vessel launched locally was built by Sir James Laing and Sons, Ltd., who are third on the list with an aggregate of 39,026 tons. Altogether the Wear's returns for the past year are the largest on record. In the Hartlepools the prospect for the present year is much better than it was twelve months ago. Messrs. W. Gray and Co. again have the largest tonnage and they have also been responsible for an unusually large amount of repairing work. In this connection Messrs. Furness Withy, and Co., who have the second largest output, have also had a busy year. The blacksmiths' strike in the early part of the year had a retarding effect on the Tees output, and this probably affected Messrs. Ropner and Sons more than the other yards, but after the settlement of the dispute continuous steady progress has been made and the firm's resources are now taxed for many months ahead. The returns of Earle's Shipbuilding and Engineering Company, Ltd., of the Humber, show that the launches numbered twenty-two against six last year, the tonnage being raised to 16,436 tons, against 12,223 for 1904. On the Clyde a record has been established. Messrs. Russell and Co., whose launches aggregate 71,540 tons, are still at the head of the list. They are followed by Messrs. C. Connell and Co. with 39,428 tons. In all, forty-four firms contribute to the output of this district, which amounts to 539,850 tons. The industry has been better at the Forth than it was last year, but it has not recovered its former position. On the Tay the total is more than double that of 1904, Messrs. Gourlay Bros. and Co. contributing largely to the increase. Collectively, the shipbuilding yards of the Dee show an output about 1,000 tons in excess of the preceding year.

SWAN, HUNTER AND WIGHAM RICHARDSON, LTD.

Name and Port of Registry.	Gross Tons Register.	Ind. H.P.
Ancroft, Newcastle	[illegible]	[illegible]
Benue, Liverpool	[illegible]	[illegible]
Sutton Hall, Liverpool	[illegible]	[illegible]
Santa Cruz, Hamburg	[illegible]	[illegible]
[illegible], London	[illegible]	475
Westminster, London	[illegible]	[illegible]
[illegible], London	[illegible]	[illegible]
Langton Hall, Liverpool	4,817	2,500
Sheerness Caisson, Sheerness	[illegible]	–
[illegible], London	[illegible]	[illegible]
[illegible], Newcastle	[illegible]	[illegible]
Nigerian Dock, Forcados	[illegible]	–
Madonna, Liverpool	[illegible]	[illegible]
Kut Sang, London	[illegible]	[illegible]
Christian Bors, Bergen	[illegible]	[illegible]
Rheinfels, Bremen	[illegible]	2,800
Lestris, Cork	[illegible]	[illegible]
Arensburg, Bremen	[illegible]	[illegible]
Oberhausen, Hamburg	[illegible]	[illegible]
[illegible], Cork	[illegible]	[illegible]
[illegible], Trieste	[illegible]	1,400
Golo, Marseilles	[illegible]	[illegible]
Total	[illegible]	48,975

VICKERS, SONS AND MAXIM, LTD., NAVAL CONSTRUCTION WORKS, BARROW-IN-FURNESS.

H.M.S. *Natal*, armoured cruiser for the British Admiralty.

H.I.J.M.S. *Katori*, battleship for the Imperial Japanese Navy.

Training-ship *Exmouth*, for the Metropolitan Asylums Board.

First-class scout *Skirmisher*, for British Admiralty.

And other boats.

Total tonnage	41,500
Total indicated horse power	[illegible]

FURNESS, WITHY AND CO., LTD., SHIPBUILDERS AND REPAIRERS, WEST HARTLEPOOL.

Name, Description and Nationality.	Gross Tons.
279 (steam), British	4,184
280 (steam), British	4,184
281 (steam), British	4,184
282 (steam), British	4,183
283 (steam), British	3,903
284 (steam), British	4,183
287 (steam), British	5,196
288 (steam), British	5,196
289 (steam), British	5,196
286 (steam), British	4,183
Total	44,592

S. P. AUSTIN AND SON, LTD., SUNDERLAND.

Name, Description, and Port of Registry	Gross Tons Register.	I.H.P.
Herrington (steel, steam), Newcastle	1,258	750
Denewood (steel, steam), London	1,217	800
Wear (steel, steam), Newcastle	1,075	650
Thames (steel, steam), Newcastle	1,079	650
Lord Stewart (steel, steam), Seaham Harbour, Sunderland	1,444	1,060
Hurstwood (steel, steam), London	1,220	800
Totals	7,293	4,710

IRVINE'S SHIPBUILDING AND DRY DOCKS COMPANY, LTD., WEST HARTLEPOOL.

	Gross Tons Register	Ind. H.P.
No. 141, *Gloriana*, British	3,364	1,500
No. 142, *Parklands*, British	3,700	1,600
No. 143, *Cameron*, British	3,353	1,500
No. 144, *Norfolk Range*, British	3,363	1,500
No. 145, *Siegmund*, German	3,650	1,600
No. 146, *Sieglinde*, German	3,650	1,600
Totals	21,080	9,300

W. GRAY AND CO., LTD. WEST HARTLEPOOL.

Name and Port of Registry.	Gross Tons Register	Ind. H.P.
Turkistan, Swansea	4,505	3,000
Gorjistan, Swansea	4,508	3,000
Pruth, London	4,408	2,000
Wavelet, West Hartlepool	2,992	1,500
Eastlands, West Hartlepool	3,113	1,500
Westlands, West Hartlepool	3,112	1,500
Manchuria, West Hartlepool	2,997	1,500
Cambyses, West Hartlepool	3,184	1,700
Cynthiana, West Hartlepool	3,185	1,700
Domira, Glasgow	3,113	1,500
Twilight, West Hartlepool	3,101	1,500
Harlington, London.	3,471	2,000
Harlech, London	3,479	2,000
Drumlorst, London	3,118	1,700
Northwaite, Cardiff	3,626	2,000
Havre, Swansea	2,924	1,250
Venus, London	3,152	1,400
Samara, Glasgow	3,150	1,400
Chelford, West Hartlepool	2,997	1,500
Totals	63,226	33,650

The tonnages given are according to the official Board of Trade Returns. If the tonnages of part shelter docks were included the total would be [illegible] tons gross.

SIMPSON, STRICKLAND AND CO., LTD., DARTMOUTH.

29 steam and motor launches of total gross tonnage of 23,168
Total i.h.p. of machinery 1,742

ROPNER AND SON, STOCKTON-ON-TEES.

Name and Port of Registry.	Gross Tonnage with Erections.	B. of T. Gross Tons.	Lloyd's I.H.P.
Blacktor, London	3,510	3,015	1,400
Burnby, West Hartlepool	3,700	3,665	1,610
Brookby, West Hartlepool	3,700	3,679	1,610
Glenmay, West Hartlepool	3,080	2,485	1,210
Stagpool, West Hartlepool	4,760	4,021	1,555
Peruviana, West Hartlepool	3,700	3,153	1,540
Carlton, Newcastle	5,480	5,262	1,985
Teespool, West Hartlepool	4,650	4,577	1,555
Foston, Hull	3,550	3,100	1,400
Totals	36,130	33,500	14,405

The above steamers are all built of steel and fitted with triple expansion engines.

PALMER'S SHIPBUILDING AND IRON COMPANY, LTD.

Name, Description, and Nationality.	Gross Tons Register	Ind. H.P.
Chama (cargo, steel), British	3,927	2,200
Wear (destroyer, steel), British	505	7,000
Swale (destroyer, steel), British	505	7,000
King Bleddyn (cargo, steel)	4,387	1,900
New fore end for H.M.S. *Syren* (destroyer, steel), British	285	–
Hymettus (cargo, steel), British	6,171	2,700
Totals	15,900	20,800

The s.s. *Siam* was launched recently from Messrs. Joseph L. Thompson and Sons' North Sands shipbuilding yard, Sunderland. She has been constructed to the order of the Societa Anonima Ungherese di Armamento Marittimo Oriente, of Fiume. Her principal dimensions are: Length about 410 ft.; breadth, extreme, 50 ft.; and depth moulded, 29 ft. 3 in. Built to Lloyds' highest class, she is of the double deck type, built to the spar deck rules on the deep frame system, and is divided by seven watertight bulkheads. Water ballast will be carried in the cellular double bottom, extending right fore and aft, and in the after peak, also in a large deep tank, which may also be used for the stowage of cargo. Steam for the machinery is supplied from a large marine-type multitubular donkey boiler. The engines and boilers are being constructed by Messrs. John Dickinson and Sons, Ltd., of Sunderland, the sizes of the cylinders being 26 in., 42 in., 70 in. by 48 in. stroke, supplied with steam by two large boilers working at 180 lb. pressure, and fitted with Howden's forced-draught arrangement.

No. 5 PLAIN MILLING MACHINE.

BY THE CINCINNATI MILLING MACHINE COMPANY.

THE above company has recently added several new sizes to their line of plain millers bringing the number up to nine. Among recent improvements are a new back-gearing arrangement and a new knee. The No. 5 machine illustrated herewith [illegible] is the largest size of plain machine designed by them for general line of heavy [illegible]. Among the features common to these machines attention may be called to the following points:

Any adjustment of the operating levers and handles can be made or any of the feeds can be reversed without the necessity of the operator changing his position. Two adjustments may be made simultaneously. The advantages of such an arrangement are obvious in any class of milling, but are especially marked in jig milling where the feeds are short and fast, when the time consumed in making adjustments and reversing feed is reduced to a minimum.

The spindle is made of crucible steel and has a hole through its entire length. The front end of spindle is threaded to receive a chuck or large cutter. A cover is provided for protecting the thread.

The machines are provided with ample spindle power and thoroughly adapted for the use of high-speed steels. We are informed that the positive feed mechanism with which the Cincinnati Company replaced feed belts five years ago on all back-geared machines, has proved entirely satisfactory in every particular, the rate of feed being changeable in an instant while the machine is working. When starting on a new piece of work the rate of feed can be increased a notch at a time until the main belt slips, thus making it easy for the operator to work the machine to its maximum capacity.

Special attention has been given to the design of the column, the knee, the table, the base and the supports for the arbor. The table has an unusual vertical depth giving it stiffness as a beam to resist being sprung when work is clamped to it. This stiffness is further increased by stout webbing.

The new knee has great vertical depth. Its bearings are wide over all and have large surfaces. It has stout transverse webs and bridges. These members resist collapsing strains due to pressure on the side of the saddle bearing when the table is heavily loaded and at the end of its travel. It is closed in on the bottom and has a vertical transverse web near the front end. This takes care of twisting strains. Its sides are not cut away to accommodate transmission gearing.

The column is a heavy box section well braced by webs on the inside. Its base is provided with a rim which forms a basin to catch all drippings which would otherwise go on the floor. The overhanging arm is cylindrical in form and made from a solid steel bar of large diameter. There are braces provided for firmly tying the overhanging arm and arbor supports to the knee, making a most rigid arrangement for supporting the outer bearing of the cutter arbor. Two styles of arbor support are provided, one being an adjustable phosphor-bronze bearing which gives a cylindrical bearing for the outer end of the cutter arbor and allows expansion of the arbor during cutting operations. The second bearing has a larger bushing and may be adjusted anywhere along the length of the arbor so as to form support close to the cutter.

The use of tangs for driving milling machine arbors has been abandoned by the firm, having been found inadequate for taking the heavy fast cuts now common in high-speed milling. The arbor is securely held in the taper hole in the spindle by means of a drawing-in bolt, extending through the spindle and operated from the rear end. This ensures that the arbor will not work loose. It is withdrawn from the spindle by forcing the large nut on the end of the taper shank against the end of the taper spindle.

The No. 5 machine has the following special features: The upper part of the feeding mechanism employs tumbler gears instead of sliding gears and provides three series of speeds, which, in connection with the standard lower gear-box gives in all 24 feed changes ranging from ·007 to ·360 inches per turn of cutter. The drive between the upper and lower gear-boxes is entirely through spur-gears.

The table feed motion is through a Sellers spiral gear drive. This gives as even a motion to the table as is obtained by means of a screw feed and at the same time permits of a quick return equivalent to the rack-and-pinion quick return on rack-feed machines; consequently, we have here the advantages of both rack-feed and screw-feed machines with the disadvantages of neither.

The countershaft complete has two friction clutch pulleys, which are driven at different speeds from the line shaft. The clutch disc is secured to the shaft to face the disc on the pulley. The holder for fingers is screwed to the body of the disc, the ends of the fingers reaching over the disc on the pulley. The fingers are of bronze and have hardened steel rollers in their far ends where they engage the clutch collar. When the clutch collar is thrust between these ends by the shifter, they are spread apart and the disc on the pulley is firmly gripped to the clutch disc. The bearing surfaces of these discs are large, and the arrangement makes a powerful drive. Helical springs release the fingers when the clutch collar is slipped back. The holder for fingers being screwed to the body of the clutch disc, provides an adjustment for wear between the discs and fingers. It can be locked in any position by means of the clamping screw provided for the purpose.

The attachment illustrated on page 58 is designed especially for milling large face and periphery cams. It will mill cams up to 24 in. diameter, 8 in. throw. It is driven direct from a separate countershaft mounted on the machine countershaft, and change-gears in the attachment provide six changes in power feed. A hand feed is also provided. It is self-contained, all the necessary movements being in the attachment itself, the table slide remaining at all times stationary.

The spindle has a No. 12 B and S taper hole for holding work, which is also convenient for centring large work, the chucking and driving of which is further facilitated by an 18-in. face plate mounted on the spindle.

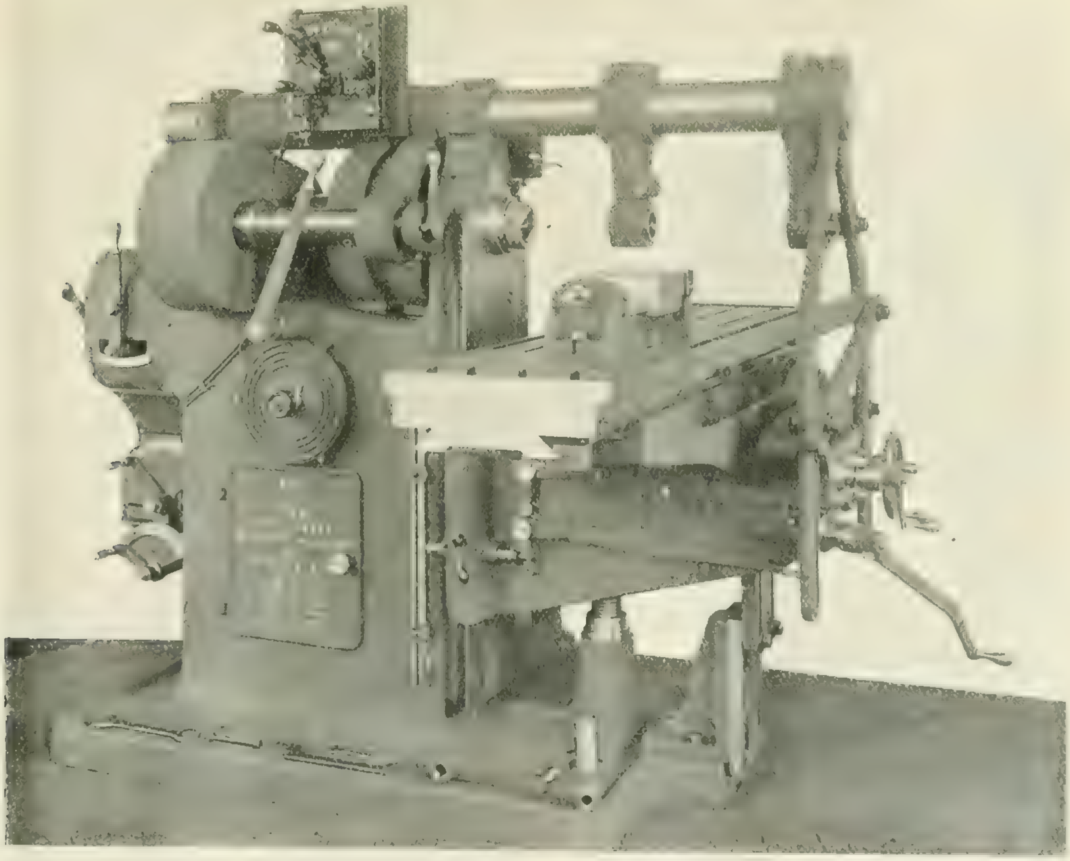


FIG. 1. NO. 5 PLAIN CINCINNATI MILLING MACHINE.

CANAL BARGE FITTED WITH THORNYCROFT SUCTION PRODUCER GAS MOTOR.
Now making a trial trip to demonstrate economy of such a plant for canal haulage.

THE FUTURE OF OUR CANALS.

THE proposal to appoint a Royal Commission to inquire into the general working and development of the canals of this country directs attention to a problem of really national importance. The fate of our inland waterways would appear to be a subject peculiarly suitable for investigation by a Royal Commission, but those interested must take care that the appointment of a Commission for the taking of evidence is only the means to an end, and that the whole thing is not thus consigned to oblivion.

Let it be said at the outset that we are not in sympathy with those critics who, even at this stage, have made up their minds that inland navigation in this country as a commercial enterprise is doomed. It may be true that the suggested revival of inland waterborne traffic is bound up with other things, as, for instance, the problem of railway rates, and that it would be easy to throw money away on ill-advised schemes for reviving inland navigation. These, however, are just the points which a Royal Commission would be competent to investigate, and its decisions would carry the requisite authority to effect reforms in the law and to justify the large capital expenditure necessary for providing through canal routes and linking up the chief ports of the country with inland traffic centres.

At any rate, the proposed Commission promises something in the nature of final [illegible] decisions, and this, at least, would be something gained. The need for investigation is quite obvious, and it is neither business nor commonsense to pursue a policy of drift. It is futile to complain of the severity of foreign competition, and, at the same time, to neglect any means by which our manufacturers may be placed in a better position to compete with their foreign rivals, and an authoritative pronouncement is the more needed because those interested have differed so widely among themselves as to the steps which should be taken.

THE QUESTION OF CONTROL

Many are of opinion that the problem must be solved by powers being given to local authorities to form canal trusts, and it is urged that such a method of procedure would be in harmony with the whole system and legislation to which we have been accustomed. The canals in England are analogous to the highways. In Continental countries the highways are generally maintained by the State, but in this country the roadways are maintained and controlled by the local authorities. Some of the great ports are entirely maintained by the municipalities; in others, municipal authorities are largely represented on the Boards which control them. There is one important difference between the Continent and Great Britain, inasmuch that in the one case the ports are comparatively few as compared with the inland population to be served, and are nearly all in the hands of one authority; in the other, they are many, they are in the hands of different authorities, and keenly compete against each other for business. Canal traffic has been the subject of more than one Parliamentary Bill in recent years. The Bill of last year, it will be remembered, proposed to constitute a Central Canals Trust for the purpose, in the first instance, of taking over and improving and managing certain specified canals which form a chain of navigation between the principal ports in England.

On the other hand, there is a feeling that the Government should itself take the lead in the matter of reform, but it must be admitted that the view has not found favour at the Board of Trade. The proposal has also been put forward that the control of canals should be within the sphere of action of an Assistant Secretary for Commerce. The weight of present opinion, however, appears to favour the control being placed in the hands of the local authorities interested. One is unable to find that any Government assistance has ever been given to canals in England, but in Scotland the Caledonian and Crinan Canals have received grants from the Exchequer amounting to one million and a quarter, and certain of the Irish canals have obtained similar assistance.

ENGLISH AND CONTINENTAL CANALS COMPARED.

It will be interesting at this point to notice the distinguishing features of the canal systems of Europe, so that the differences between the English and Continental canals may be appreciated. As Mr. Vernon-Harcourt, the well-known writer on this subject, points out, the differences in dimensions of canals and their locks, constructed in former time by different companies, resembling differences in gauge on railways, have seriously impeded the development of through routes and the extension of inland navigation. The inland canals of Great Britain can only, for the most part, afford a passage for barges 72 ft. long, 7 ft. to 15 ft. wide, and drawing 3 ft. to 5 ft. of water; and little has been done on a comprehensive scale to meet modern requirements, except by the Aire and Calder Navigation and the Weaver Navigation.

In France, on the contrary, the main lines of waterways have been gradually remodelled and necessary links constructed since 1879, so as all to conform to the minimum standard depth of 6½ ft., to be increased eventually throughout to 7¼ ft., and give access to vessels of 300 tons, 126 ft. long, 16½ ft. wide, and from 6 ft. to 6½ ft. draught.

In Germany, where the rivers furnish the chief routes for inland navigation, the depths of the canals connecting them range mostly between 5 ft. and 7 ft., but the New Dortmund-Ems Canal has been given a depth of 8½ ft. in cuttings and 11½ ft. on embankments to reduce the earthwork, with a bottom width in cuttings of 59 ft., and side slopes of 2 to 1, flattened to 3 to 1, near the water-level. It allows of the passage of vessels of 600 tons.

The main inland canals of Belgium have depths of from 6½ ft. to 13½ ft.; whilst the new Canal du Centre, with a depth of 8 ft., has been made large enough to admit vessels of 400 tons. The Merwede Canal in Holland, completed in 1893, has depth of 12½ ft., a bottom width of 65½ ft., and side slopes of 2 to 1; whilst the lately reconstructed Marie Canal in Russia, crossing the water parting of the Volga and Neva Basins, and thus forming a link in the waterway connecting the Caspian Sea and the Baltic, affords access to vessels of 655 tons, 210 ft. long, 31½ ft. wide, and 6 ft. draught.

OTHER SUCCESSFUL CANALS.

The lateral Soulanges Canal in Canada, for avoiding the rapids of the River St. Lawrence, and forming a new link, opened in 1900, 14 miles long, in the improved waterway between the river and the great Lakes, for vessels of 14 ft. draught, has been given a depth of 17½ ft., a bottom width of 96 ft., and side slopes of 2 to 1, protected by rubble pitching near the water-level, and allows the passage of vessels of over 2,000 tons; whilst the Sault-Sainte-Marie Canal, connecting Lakes Huron and Superior, so as to avoid the Rapids of the St. Mary River, has been made 22 ft. deep and 145 ft. wide at the bottom, and consequently approximates in dimensions to a ship-canal. The new Chicago Drainage Canal, primarily constructed for diverting the draining of Chicago from Lake Michigan into the Illinois River, but also designed to be the first length of an improved waterway between the Lakes and the Mississippi, has been given very similar dimensions, with bottom widths of 160 ft. in rock and 200 ft. in clay, side slopes of 2 to 1, and a depth of 22 ft.

CAUSES OF FAILURE IN BRITISH CANAL SYSTEM.

The canal systems of England call for detailed notice, and readers may be reminded that many British waterways have, since the inauguration of the railway era, been practically stagnant. The policy of railway companies has been to acquire the canals wherever possible, and thus dispose of what would have been powerful competitors for traffic had they remained under independent control. The figures of the Board of Trade returns for 1898, the latest year available, gives particular point to this statement. It appears that, while 2,768 miles of canals under ownership outside the railways carry 33,348,573 tons of traffic per annum, at a net profit of £210 per mile, 1,138 miles owned by railway companies carry only 6,009,820 tons per annum, at a profit of £4 per mile of navigation. To a great extent it is a question of management. That this is so is proved by the success which attends the operations of the Aire and Calder, the Weaver, and one or two other navigations, to which detailed reference will hereafter be made. One of the main causes of the present derelict condition of the canal system is undoubtedly the want of uniformity of gauge, to which a brief reference is made above. Except for the smaller class of boats there is no through route. The capacities of British canals vary from the Potteries Canal link, which can only take 20 ton boats, and through several stages ranges up to the 300-ton boats which can use the Weaver up to Anderton. Clearly, one of the first reforms of English canal systems must be to bring about uniformity of gauge. As to what the standard gauge should be, opinions vary, but Mr. J. A. Saner, the engineer of the Weaver system, suggests a bottom width of not less than 40 ft. to 45 ft., and a top width of 80 ft. to 85 ft., with a centre depth of 8 ft. The locks should be 230 ft. long, by 22 ft. wide, with 6 ft. 6 in. draught of water on the sills clear of obstruction. This would accommodate two lighters of 250 tons carrying capacity.

SUGGESTED MAIN ROUTES

The main English canal routes to which importance may be attached are those which link, or could be made to link, the ports with the chief manufacturing districts; thus, London and Birmingham and the Midlands, Bristol, Liverpool and Hull with the Midlands; while, as a cross-country route, the linking of Mersey and Humber navigations is the most feasible. The London to Birmingham route is largely in the hands of the Grand Junction Canal Company, and is a fine waterway, which, except at the Birmingham end, has been well maintained. The communication between Birmingham and the Bristol Channel ports could be easily improved. As far as Worcester, 43 miles from Gloucester, river barges can be navigated, with maximum dimensions of 135 ft. in length, by 22 ft. in width, and draught of 8 ft. 6 in., but, for the 30 miles to Birmingham, the largest barge which can be navigated is only 71 ft. 6 in. in length, 7 ft. in width, and drawing only 4 ft. of water. The consequence is that every barge of water-borne traffic to the Bristol Channel port must be transhipped either at Worcester or at Gloucester. One portion of this communication is *viâ* the tidal waters of the Severn, where it is not safe for small canal barges to navigate. In the Hull to Midlands route, the Trent navigation plays the main part, and it presents no particular difficulties. The route would be *viâ* Gainsborough, Newark, Nottingham, Fradley, Fazeley, and Birmingham, where a link would be found with the London and Birmingham route.

Nor would the cross-country route present any difficult features as far as Wakefield, up to which point the change of level is insignificant. On the Rochdale Canal an elevation of 600 ft. has to be encountered, and this necessitates an expensive lock system, the number of locks averaging three per mile. Probably, in view of the expense of reconstructing this series of locks, lifts and inclines could be used, and a summit tunnel at Stansfield might be constructed. Undoubtedly, however, a very important through route and one to which attention should be early directed is that from Liverpool to the Midland Counties, *viâ* Manchester and the Potteries, more particularly as it presents no engineering difficulties of any magnitude.

COST OF IMPROVEMENTS.

On the subject of the cost of improving the main canal route, but few figures are available, but a total of £10,000,000 has been suggested, although we are inclined to regard the estimate as altogether too moderate. If, however, the work of improving main routes can be carried out for anything approximating to this sum, the work ought to be put in hand at once. That the financial results would justify such a comparatively small expenditure appears to admit of but little doubt. Other countries, as we shall show, have not hesitated to spend large sums on the improvement of inland waterways, and the results have been such as to warrant the inauguration of such a policy in England.

IMPROVEMENTS ABROAD—GERMANY

In Germany, the chief points of the scheme, as now sanctioned, may be thus summarised. The total cost is £16,728,750, of which £12,537,500 fall to the cost of building the canal from the Rhine to the Weser, including the canalisation of the Lippe and various accessory works. A sum of £2,150,000 is granted for the making of a canal for large vessels from Berlin to Stettin; £1,058,750 goes to improving the waterway between the Oder and Vistula, and to better a portion of the Warthe, and £982,500 is allowed for the canalisation of part of the Oder. Germany has 8,798 miles of canal.

FRENCH CANAL SYSTEMS.

The French Government were authorised by a law of December 23rd, 1903, to carry out a certain number of improvements and new works at an estimated expenditure of £5,242,000, of which a sum of £1,166,000 is to be appropriated to completing works of improvement already begun on waterways, and £4,076,000 is to be devoted to new works.

The French waterways at present in the hands of public bodies other than the State form only an insignificant fraction of the whole; practically the whole of the waterway system is the property of the State, which maintains it out of the funds free of all tolls. Up to a recent date France had expended about

£27,000,000 on navigable waterways. This enterprise has been accompanied by a great development of inland water traffic, and it is noteworthy that during the same period the railway traffic has also largely increased, though far less rapidly in proportion. The canal built to connect the Marne with the Rhine has given a wonderful impetus to the mineral and other industries of Lorraine. It is stated, indeed, that 83 per cent. of the industries upon its banks have been established since the canal was cut.

AUSTRIA-HUNGARY.

Austria-Hungary possesses internal navigable waterways of the approximate length of 4,000 miles, on which between 1848 and 1898 £21,000,000 were expended. Mr. Bennett, the Commercial Attaché to the British Embassy at Vienna, reports that owing to the rapid development of the railway system at the beginning of the latter half of the nineteenth century, river traffic in Austria-Hungary as elsewhere lost for some time the importance which it had previously possessed, and it almost seemed that on some rivers it would come to a complete standstill. To this circumstance may be ascribed the fact that it is only of comparatively recent date that earnest attention on the part of the State has been given to river regulation, for it has become evident, in the face of the ever-increasing traffic, that the railways are not in a position to grant those cheap rates which economic interests demand, more especially for the carriage of bulky merchandise of small value.

By the law of June 11th, 1901, over £10,000,000 was voted for the construction of a network of navigable canals in Austria and for the necessary river regulation in connection therewith. The first period of construction is reckoned from 1904 to 1912, at the expiration of which a new credit will be demanded for the completion of the scheme. The principal engineering difficulty appears to be connected with the system of lifts, which it is proposed should be employed on the canals in lieu of "locks." An international competition for various types of "lifts" was held at Vienna in 1903, but the finding of the expert jury appointed by the Government to report on the rival schemes was not made known until the end of last year. A trial "lift" is now to be constructed at Aujezd, near Preran, in connection with the Danube-Oder Canal, and will be tested prior to the actual commencement of the canal construction. Upon the result of this trial will depend the Government's final decision in favour of lifts or locks for the entire canal system.

The internal navigable waterways of Hungary possess a total approximate length of 2,082 miles. In thirteen years the river traffic of the country has increased from 2,520,000 tons to 3,640,000 tons. With the projected new navigable canals on a large and comprehensive scale the question of inland navigation is entering upon a new and important phase, and is at the present time largely absorbing public attention in the Dual Monarchy.

BELGIUM.

In Belgium the capital expended by the State during the period extending from 1875 to 1900 on the improvement of navigable waterways and harbours is estimated at £16,000,000, and this work of improvement is claimed as one of the principal factors of the commercial prosperity of the country. The State administers the greater portion of the system, but certain portions of the inland waterways are administered by the provinces, some by communes and municipalities, and a small proportion has been conceded to companies, associations of landowners, and individuals.

HOLLAND.

Long before the construction of railways the waterways of Holland were the traffic carriers of both goods and passengers throughout the land at rates so low that competition on the part of any other known means of transport was, and remains, a practical impossibility so far as local goods traffic is concerned. As late as forty years ago there were only three existing lines of railway of any importance in Holland, and these had a hard struggle for existence. About the year 1860 the urgent necessity for railways was forced upon the Government, but it was impossible to induce private capital to undertake a competition with the abundant and excellent waterways with which the nation was provided. The construction of a considerable network of railways was therefore undertaken by the State, and with excellent judgment, for the railways have proved the salvation of many districts which seemed doomed to decay. The State railways were constructed at the cost of the Select Committee on Canals, which sat in 1883, an exhaustive analysis is made of the practical result to the railway companies of the low rates charged by them for certain descriptions of traffic. Mr. Conder estimated that in 1877, the loss to the shareholders of railway companies on the carriage of coal to London alone amounted to £822,000 per annum, and, if this be correct, the total loss to-day must be largely in excess of these figures. The heavy mineral traffic carried by the companies has necessitated an enormous capital expenditure in the duplicating and quadrupling of their main lines, and in the building of miles of sidings and station accommodation.

(*To be continued.*)

A NEW INSTRUMENT FOR SURVEYING DEEP BOREHOLES.

By J. B. Porter, D.Sc., M.Can.Soc., C.E.

IT is a well-known fact that deep borings are seldom true, and although artesian wells seldom depart very much from the vertical owing to the method of drilling them, yet diamond drill-holes and other borings with rotary apparatus very frequently drift very far out of line. So long as the hole is not deep this drifting is not a serious matter, but on holes of say 1,000 ft., the departure from line sometimes exceeds ten per cent. In extreme cases, such as certain very deep recent borings near Johannesburg, holes which were intended to be vertical have drifted more than 2,500 ft. to one side of their aim.

In view of the great cost of these deep borings it is extremely desirable that the exact location of cores brought to the surface should be determinable, and a number of devices have been introduced within the last few years for the purpose of surveying holes. Most of these devices are comparatively crude and their use involves a great deal of labour.

The apparatus most generally used of late years has been a cylinder of glass, partially filled with hydrofluoric acid. This cylinder, usually less than 1 in. diameter, is enclosed in a brass case and attached to the end of a string of screwed rods and lowered into the hole to a known depth were it is left for some hours and then withdrawn. The inclination of the hole can easily be read from the glass vessel, as the upper surface of the hydrofluoric acid etches the glass quite distinctly but the direction of the hole can only be determined by marking the orientation of the top rod while the etching is taking place, marking each joint when the rods are taken apart and finally screwing them together again on the surface in order to compare the orientation marks with the etching on the glass tube. By surveying points at distances of say 300 or even 500 ft., the general course of a bore hole can be determined by the method above described, but the method is laborious and costly and owing to almost unavoidable twisting of the rods the results have seldom proved very satisfactory.

Another method of surveying involves the use of plummets and compasses immersed in a solution of gelatine which slowly hardens after the apparatus has been sent down the hole. This device, although very ingenious, has proved very difficult in use and has not met with much success, especially in deep holes. A very recent form of the apparatus uses paraffine in place of gelatine. The instrument contains an electric resistance and is connected with a dynamo on the surface by double insulated cables. The compass and plummet remain fixed in the solid paraffine while the instrument is lowered to the station in the hole. Current is then sent through the cable and the paraffine melted. The current is then shut off and after sufficient time has elapsed for the paraffine to solidify the instrument is reeled in and its records read. The apparatus should give accurate results, but the long line of insulated cable is costly and liable to injury. (Marriott—Trans. Inst. Min. and Met., Feb., 1905.

A few months ago an instrument maker in Johannesburg designed a very ingenious apparatus containing compass, plummet, small cameras and electric light, the whole connected with a small adjustable clock so that the light could be turned on for a given period after the apparatus had been lowered into the hole. This apparatus was described by its inventor, Wm.

Helme, at a meeting of the Institute of Mining Surveyors of the Transvaal. It has since been used in surveying a number of holes and has proved extremely satisfactory.

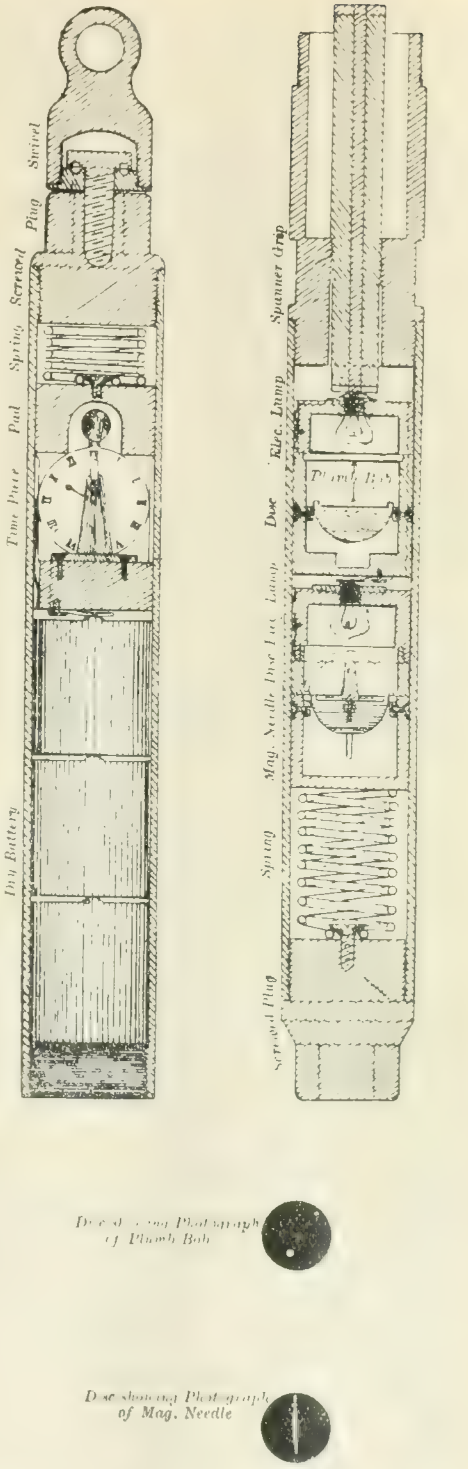
A prominent mining engineer of the author's acquaintance states that he has had the machine tested by surveying several holes twice and has found the readings to agree so closely in all cases that he scarcely considers it necessary to take check readings unless the first set show some unusual change of direction in the hole. The apparatus, instead of requiring rods, the use of which involves a great expenditure of time and labour, and the use of a derrick and a power hoist, can be lowered on the end of a piece of flexible wire from a large reel and thus several observations per day may be taken by two men.

The writer has not had an opportunity to use the instrument in actual surveying, but has taken a number of observations with it on the surface and has found its records interesting and apparently exact. He therefore feels justified in submitting the following brief description of the instrument taken from the original paper by its inventor.

Briefly described, this instrument is one in which both dip and deviation are recorded by means of photographs of the positions of both a plumb-bob and a magnetic needle at any desired point in a borehole. The photographs are taken by means of two small electric lamps lit by a "time contact."

DETAILED DESCRIPTION OF THE INSTRUMENT.

The instrument comprises a brass cylinder 20 to 30 in. long ; both length and diameter are varied to suit the particular requirements. The cylinder is made in two portions, which screw together quite flush shoulder to shoulder. The top and bottom are closed by means of tightly-fitting screwed plugs. To the top plug is attached a brass swivel with an eye piece, by which the instrument is suspended. The swivel



INSTRUMENT FOR SURVEYING DEEP BOREHOLES.

is fitted to the plug with ball bearings. The object of this swivel is to prevent the wire, which is used in lowering the instrument, from twisting; also, to minimise risk of the instrument kicking against the sides of the borehole when being lowered or raised.

Inside the cylinder, immediately beneath the top plug, is a spring resting on a pad, which keeps firmly in position a small watch or timepiece. Below the watch is a dry battery. Below this again is arranged a tiny electric lamp, and below the lamp is a glass plate, from the centre of which hangs a small plumb-bob. Below the plumb-bob is a circular brass plate supported on gimbal bearings, so that it always remains in a horizontal position. On this plate is placed a small disc of sensitised paper. Below this is another electric lamp, and below this again is a compass, which is also supported on gimbal bearings. On the dial plate of the compass is placed another disc of sensitised paper; each disc is pierced by a pin-prick in the centre, and another on one side, and both discs are fixed in exactly the same relative position, one above the other, when in the instrument.

The whole is kept firmly in position from below by another spring placed under the little cup holding the magnetic needle, and resting on the bottom screwed plug. When the hand of the watch is passing the 12 o'clock point on the dial, it makes contact for about 15 seconds with a small projecting spring made of copper foil, which is connected with one line from the battery. The hand of the watch is connected with the other line; and so, when in contact with the spring, the circuit is completed; both electric lamps are lighted; and photographs are taken of the positions of the plumb-bob and the magnetic needle. It is only necessary to set the watch so that the hand will only pass the 12 o'clock point after sufficient time has elapsed to allow for the instrument being lowered to the required depth, and also to allow for the plumb-bob and magnetic needle having come to rest.

In practice, it is usual to take readings at, say, every 200 ft. to 300 ft., and two readings should invariably be taken in each instance. When once the photographs have been obtained, the rest of the work is easy; for, the height of the point of suspension of the plumb-bob above the centre of the disc being known, and the distance of the lower end of the plumb-bob from the centre of the disc having been obtained by accurately measuring the distance between the centre of the photograph of the plumb-bob and the centre of the disc, the angle of dip can be calculated.

The direction is also easily obtained by placing the two discs in the same relative positions which they occupied while in the instrument, which can at once be done by means of the two pin-pricks on each. The direction of the line joining the centre with the image of the plumb-bob on the one disc will then (unless it happens to fall in the magnetic meridian) make an angle with the photograph of the magnetic needle on the other disc, and from this angle the magnetic direction of the path of the borehole at that particular point is determined. In surveying a borehole, say 4,000 ft. in length two sets of readings should first be obtained at regular intervals, which should not exceed 250 ft. in length. When these have been obtained, the dip and deviation must be calculated for each point, and then sufficient data are available to plot, in plan and section, the true path taken by the borehole.

Read before the Mining Section of the Canadian Society of Civil Engineers.

An official report on the motor steam fire engine sent to Cape Town by Messrs. Merryweather and Sons of London, states that several record runs have been made along some of the main gradients of Cape Town with the greatest of ease, the brakes having acted admirably. As regards pumping capacity two 1 in. jets from the 3 in. delivery and two jets 1 in. from the 2¼ in. deliveries were simultaneously delivered about 100 ft. high, 120 lb. of steam being steadily maintained.

THE AMERICAN NAVY.

The American first-class battleship, *Idaho*, recently launched from the ways of the Wm. Cramp and Sons' Ship and Engine Building Company, of Philadelphia, has a length of 375 ft., a beam of 77 ft., and a mean draught of 24 ft. 8 in., corresponding with a displacement, under normal conditions, of 13,000 tons. The vessel will be propelled by twin screw, triple-expansion engines, giving an indicated horse-power of 10,000, and providing the ship with a speed of 17 knots.

The experiences of the battle of the Sea of Japan have not been of much service to American naval experts in arriving at the most effective dimensions of future battleships. In his annual report, the Secretary of the Navy remarks that the war has taught little, if anything, about the utility of submarines. It has caused, or at least left, much difference of opinion as to the value of armoured cruisers, and it has created a still more serious divergence of views respecting the best limit of size for the future battleship. As a matter of fact, no battleship of as much as 16,000 tons displacement was used by either belligerent, and while, on the one hand, at least one Great Power has determined upon the construction of an 18,000-ton battleship, and others are reported to have in contemplation vessels from 20,000 to 22,000 tons, on the other, some authorities think these leviathans will prove less formidable and more vulnerable than battleships of 16,000 tons, such as the contemplated *South Carolina* and *Michigan*.

The Navy Department has been caused "serious concern" by the conflicting advice on this question, which has been tendered by its authorised expert advisers, but after very carefully weighing the divergent views, the Secretary has decided that it is not as yet sufficiently clear that larger and more costly battleships would have such increased efficiency in battle as to justify the certain addition to the public burdens involved in accepting the views of the General Board.

As regards shipbuilding policy, the Secretary remarks that if circumstances remain as they now are he sees no reason to suppose that the number of ships in the American Navy need increase; on the contrary, it is reasonable to anticipate that their number will be reduced, and even reduced materially, within the next five years. What is more important, however, than the mere number of ships on the register, is the size of the fighting fleet, and here again, supposing that no developments at present unforeseen occur in the factors of the problem, it seems probable that no increase, but on the contrary some slight reduction, may be anticipated within the period above mentioned in the number of vessels composing the fleet.

This statement, however, must not be misunderstood. It does not at all mean that the building of new ships will be abandoned; on the contrary, the necessity for vessels of an improved type, to take the place of those now recognised as obsolete, or evidently destined to become such, has grown plain and urgent. While any discussion of future needs and the proper means to meet them must be, of necessity, largely conjectural, the Secretary thinks it may be safely said that if the situation is not complicated by any unforeseen developments, the American programme of naval construction for the future in so far as it relates to the American fighting fleet alone, should consist in substituting five new battleships and two new armoured cruisers for the oldest vessels [illegible] these types on the register, and five more battleships for the ten coast defence vessels of the monitor type, and that these substitutions should be made, at latest, within the next six years.

SAFETY MEASURES IN MINING.

By Donald Macaulay, M.A., M.B., C.M., and Louis G. Irvine, M.A., M.D., B.Sc.

THE title of this article is somewhat wider than the subject with which we propose to deal, for we intend to call attention only to such measures for the prevention of disease and death amongst the mining community as come within the special experience of the medical officer of the mine. That the subject, even in this limited sense, deserves the consideration of a society which has done much in the past to further the best interests of the mining industry, must be apparent to every one familiar with the literature and statistics of mining life and work.

While there may be difference of opinion as to the causes which are at work to produce the present unhealthiness of metalliferous mines, there can be none as to the fact. One need only state that Dr. Haldane found that "between the ages of 25 and 4[illegible] the death rate from lung diseases among miners living in Cornwall has recently been from eight to ten times the corresponding death rate among coal miners or ironstone miners." The report of the Transvaal Miners' Phthisis Commission also abundantly proved that an excessive mortality occurs among our underground workers, a mortality which is so serious, that unless conditions under which the miners work are greatly improved, we believe that the supply of skilled miners will become as serious an economic problem as was some time ago the supply of unskilled labour. We hope later on to show that several of the conditions inherent in the occupation, which go to endanger life and health, might certainly be mitigated by preventive measures.

It is also unfortunately true that the occupation is a dangerous one. We find that during the last official year [illegible] separate serious accidents were reported to the Government Mining Engineer's department, equal to 8·36 per 1,000 persons employed in the mines and works of the Transvaal. There were at the same time 602 deaths due to accidents—a pretty heavy toll.

The following table, which we owe to the courtesy of the Acting Government Mining Engineer, is a most instructive one :—

ALL ACCIDENTS.

Owing to danger inherent to work itself—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Through fault of fellow workmen—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Through carelessness or ignorance of injured person—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Owing to defective plant or material—	
No. of separate accidents	[illegible]
Per cent.	2·15
Total number of separate accidents	[illegible]

FATAL ACCIDENTS

Owing to danger inherent to work itself—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Through fault of fellow workmen—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Through carelessness or ignorance of injured person—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Owing to defective plant or material—	
No. of separate accidents	[illegible]
Per cent.	[illegible]
Total number of separate accidents	[illegible]

This table strikingly illustrates the fact, which is a matter of only too obvious experience, that many valuable lives are lost on the mines of the Transvaal through the carelessness of the workers, or through ignorance or neglect of the most elementary precautions.

In the following pages are considered practical measures to be taken in the case of the occurrence of accidents.

This section of the subject falls naturally under two headings :—

A. Measures in cases of ordinary accidents [illegible]

B. Measures in cases of gassing.

MEASURES IN CASES OF ORDINARY ACCIDENTS.

I. METHOD OF TRANSPORT.

It is desirable that on all mines, and more especially on deep levels, a kind of stretcher should be introduced which will enable injured persons to be conveyed along stopes, drives and up incline and vertical shafts with more comfort and safety than is possible with the primitive arrangement now in use. The essential feature in the construction of such a stretcher must be that the injured person can be so secured to it as to permit of its being conveyed in any position—horizontally, on the incline or vertically—without disturbance to the patient. This can be done by securing the patient to the stretcher by the fork and the arm pits. This is impossible with the stretchers in ordinary use, and the sufferings of a man with *e.g.*, a broken leg are greatly and needlessly aggravated by such a crude method of conveyance. An appliance of the nature we indicate is used for the transport of wounded in the Navy, and, with modifications for local conditions, such a stretcher should be constructed for the mines and employed for the transport of wounded from underground.

As a part of each stretcher equipment there should be kept at each headgear a box of emergency splints and dressings, to be sent down in cases of accident. This box must be of suitable size for easy conveyance in the skip, and be furnished with a handle for underground transport. It should contain a complete set of Levi's metallic splints, which are light and indestructible, with bandages, dressings, and tourniquets. It should be under the charge of a responsible official, and under no circumstances be tampered with for trivial accidents which has, in our experience, been the fate of surgical stores at headgears.

There should be a special signal for accidents, indicating the level at which the accident has occurred, and on receipt of this signal this stretcher equipment together with other safety appliances, which we will detail later should be sent down to the proper level.

For transport on the surface except for long distances hand carrying is much more comfortable than any form of wheeled ambulance.

All mine officials, and indeed all skilled miners, should have a knowledge of elementary first aid to the wounded. More especially should they know two things :—

(1) To arrest hæmorrhage.

(2) To temporarily secure a fractured limb.

It is very easy to stop bleeding in an arm or leg by applying a rubber tourniquet, such as the stretcher equipment box would contain, or even a strip of a shirt, very firmly round the limb between the wound and the body. On the head or the trunk firm pressure on the wound itself is the only temporary measure which can be used.

The second point is the application of temporary splints to fractures. A suitable splint can easily be selected from the set supplied ; and it is essential to remember that to secure immobility of the fracture the joints above and below must be secured. For fractures of the thigh the handy jumper can effectively take the place of the soldier's rifle as a temporary long splint.

These are very elementary facts ; but ignorance or neglect of them has not infrequently resulted in the loss of life or limb. More than once we have found a native or a white man brought to the hospital bleeding freely and already at the point of death from loss of blood ; and when we asked why no measures were taken to stop the hæmorrhage we have been told that they had no time to think of that, their one idea being to get him to the hospital as soon as possible.

MEASURES IN CASES OF GASSING

The poisonous gases which rise in mines, and which for practical purposes need here to be considered are CO_2, CO and NO_2.

CO_2, the "choke damp" of collieries, arises from a variety of causes in all mines ; in metalliferous mines large quantities may result from an accumulation of the gas derived from a complete detonation of nitro-glycerine explosives which has not been dispersed by adequate ventilation. Poisoning from this gas alone is rare. The presence of dangerous quantities is revealed by the extinction of the flame of a candle.

CO is produced in collieries as the result of explosions or fires ; while in metalliferous mines it results, along with varying quantities of NO_2, from the incomplete detonation or the combustion of nitro-glycerine explosives. Poisoning by these gases is very common and frequently fatal. It is necessary, therefore, that miners should be made clearly to understand (1) the precautions which must be taken when persons are about to proceed to places where an accumulation of these gases is suspected together with the simplest means for detecting their presence ; (2) the measures to be adopted when cases of poisoning actually occur.

PRECAUTIONS WHEN PERSONS ARE ABOUT TO PROCEED TO PLACES WHERE GAS IS SUSPECTED.

The recent lamentable loss of life at the Vereeniging Collieries seems to prove that the necessity for special precautions is little appreciated in South Africa and the frequency with which "gassing" occurs among miners and the unskilled workers under their care can only be attributed to ignorance or to more culpable carelessness.

The story of the Vereeniging disaster as related in the report of the Inspector of Mines reveals a heroic devotion to duty coupled with an utter disregard of the most elementary precautions which can hardly be surpassed. Knowing that a portion of the mine was on fire and knowing that several natives and white men among them had suffered severely from gassing, as what their experience must have taught them could only be CO, and without testing as they went for dangerous quantities of the gas, or providing themselves with any safety appliances or keeping themselves in touch with safety by means of a chain of men, four responsible, highly trained, and experienced mine officials flung themselves into the jaws of death. Several others who attempted to go to their rescue were no less careless and some no less unfortunate. And yet the verdict of the inspector of mines and of the examining magistrate was that "there was no breach of the regulations." Surely, then, it is high time the mining regulations were so amended that carelessness of this nature, even if heroic and in the discharge of duty, should constitute a grave breach.

RESPIRATION MASKS.

In two particulars at least the mining regulations stand in need of amendment. It should be provided by law that at every mine, some kind of safety appliance should be supplied, such as the Vajen Bader safety helmet, which is very simple in its construction, very efficient in its action and not too cumbersome to wear. It posesses the advantages that ordinary atmospheric air is compressed into the reservoir, that it does not require O_2 or any apparatus more complicated than a bicycle pump to fill it, and that it has no rubber bags of tubes to perish or go out of order. It is made in two sizes, to run for one or three hours.

There are numerous similar devices in the market, such as the Walcher Gaertner respiration bag with O_2 bottle and soda flask, and Neupert's apparatus. Others are made by W[illegible] and Co. and by Zimmer and Co., of London.

Of some such device two at least should be kept on every mine, a single person being useless for rescue work. And it is important that all points respecting the fitting out and performance of rescue work together with instruction in the use of this or any other appliance should be accurately defined and practised beforehand. Many of the mines, benefiting by recent experiences, are providing fire plant and appliances, and forming their men into an organised fire brigade under the charge of the resident engineer. The fitting out and performance of underground rescue work should naturally form part of the instruction and drill of such an organisation.

With regard to respiration masks generally, it is well known that even men who are skilled in their use are only too prone to open the air inlet valve unduly wide, thus inducing too high a pressure inside the mask, and thereby increasing the difficulty of breathing and necessarily shortening the working period of the apparatus. (Wabner.)

On receipt of the signal that an accident has occurred on a level, this respiration apparatus together with an O_2 cylinder should accompany the stretcher equipment already described. This should always be the rule, as time is only lost by waiting for a detailed account of the nature of the accident which has occurred.

TEST MICE.

The second provision which should be made in the law is that a supply of white mice should be kept at all collieries. They would frequently be useful also at metalliferous mines. It is well known that these animals are peculiarly susceptible to poisoning by CO, their susceptibility being so great that they can be employed as a reliable test for dangerous quantities of the gas. The respirating exchange in a mouse is twenty times as rapid as in a man, and consequently the mouse exhibits symptoms of blood saturation much more rapidly. Dr. Haldane proved that with 0·4 per cent. CO in the air, a mouse gave symptoms of illness—staggering gait—in one and a half minutes, and that it became unconscious in three minutes, whereas he himself did not feel discomfort for half an hour. This gives a sufficient interval to the miner to escape. Haldane lays down the rule that air must be regarded as dangerous the moment the test mouse becomes incapable of motion. The law should, therefore, provide that whenever there is a suspicion of an accumulation of CO in collieries or metalliferous mines these animals should be used as a test.

It is quite certain that had the officials of the Vereeniging Colliery worn safety helmets like the Vajen Bader, and carried with them test mice, they would have been able to explore the mine with perfect safety to themselves, and have located dangerous accumulations of gas, and so not risked the lives of their workmen.

Nitrous fumes fortunately reveal their presence by their peculiar pungent odour. But there is a great and urgent necessity that mine officials and miners should be made to realise the danger of exposure to even small quantities of these gases; for the reason that exposure to the diluted gas for several minutes may cause little or no initial distress and yet give rise several hours after arrival in the fresh air to the most grave symptoms frequently ending fatally. For instance a man under our care who was not even conscious of having been gassed developed typical symptoms of the irritant pneumonia which follows inhalation of these fumes, and died after an illness of nine hours. Another of our cases, a contractor, in his anxiety for a big cheque at the end of the month disregarded the warning of the shift boss, who suspected burning dynamite and returned to the end of the drive one hour after blasting. Ten minutes there sufficed to produce a typical illness which nearly cost him his life, and enabled us to test the value of a method of treatment to which previous, less fortunate cases had given the clue. It should, therefore, be laid down that no man should attempt, or be allowed to work in an atmosphere where red fumes are perceptible to the smell. White men must be rigorously careful in this respect, not only for their own sakes, but also for the sakes of the natives or Chinamen working them, who are through excusable ignorance more heedless of the dangers into which they are introduced. Our experience goes to show that fatal gassing from this cause, which has passed unrecognised, is more common among the unskilled workers than has hitherto been realised.

MEASURES IN KNOWN CASES OF GASSING.

Before discussing the measures which should in every instance of gassing, be systematically adopted, pending the arrival of medical assistance, it is well to briefly describe the salient features of poisoning by the three gases commonly found in our mines.

SYMPTOMS OF CO_2 POISONING

CO_2 is irrespirable and incapable of support in life; it renders arterial blood rapidly venous and is in itself a narcotic poison.

When air contains an undue proportion of CO_2 the effects are not very noticeable until the proportion reaches 3 per cent. The breathing then becomes deeper, and any exertion causes unusual panting. The depth and frequency of the respirations increase with the percentage of the gas present. At 5 per cent. there is marked panting during rest; at 7–8 per cent. there is great oppression and painful panting. At 10 per cent. the difficulty is very severe. At a slight increase beyond this stage suffocation ensues, and consciousness is lost, not, however, necessarily with fatal results if the subject is removed to fresh air. It must be carefully remembered that resuscitation is possible long after the stage of insensibility.

Loss of consciousness is preceded by headache with great pressure in the temples, giddiness, drowsiness with loss of muscular power, profuse perspiration and nausea, singing in the ears and a pungent sensation in the nose, similar to that experienced in drinking gaseous drinks.

A person poisoned presents livid colouration especially about the eyelids, lips and throat.

The amount of CO_2 in air sufficient to extinguish the flame of a candle is variously stated by different observers as from 5 to 17 per cent. It depends in a large measure on the percentage of O_2 in the mixture. Thus Haldane found that 75 per cent. CO_2 did not extinguish a flame, if the remaining 25 per cent. consisted of O_2. In any case it may be laid down as a rule that an amount sufficient to extinguish a flame will prove a lethal dose to man.

Pure poisoning from this gas is rare in metalliferous mines but it may occur in blind ends after blasting.

POISONING BY CO.

CO is a colourless, tasteless, and inodorous, but combustible gas with a specific gravity of 0.967. Being imperceptible to any of the senses it is extremely insidious and dangerous. It is a virulent poison on account of its chemical avidity for hemoglobin which is stated to be 200 to 250 times greater than that of O_2. Symptoms are produced when ·05 per cent. is present in air, and fatal results with ·2 to 1 per cent. With 1 per cent. CO in air saturation of the blood takes place in not longer than 5 to 6 minutes, and when blood has reached 70 per cent of saturation death is inevitable.

The symptoms of poisoning with this gas are feeling of discomfort with throbbing of the blood vessels, followed by headache, giddiness and great muscular weakness; there may be sickness and vomiting. A drowsy feeling creeps on, gradually ending in unconsciousness. Respiration is accelerated and laboured. More or less extended patches of bright colour make their appearance on the anterior part of the body. But it is a mistake to look in a poisoned person who is still alive for the rosy red healthy appearance which is so characteristic a feature in the dead body on account of the brilliant appearance of COHB blood. On the contrary in a poisoned person the skin is dusky, and the lips and extremities blue.

POISONING BY OXIDES OF NITROGEN—NITROUS FUMES.

The conditions under which the various gases are produced in the mines render it probable that almost all cases are to some extent cases of mixed poisoning. Yet in practice we find the symptoms of one or other predominate, sometimes to the exclusion of the appearance of poisoning by any other gas. Thus poisoning by nitrous fumes has come to be regarded and recognised by us as a distinct entity deserving of very careful consideration.

There is a history in almost all cases seen alive of having been in the mine after it was "gassed," i.e., they are considered to have been exposed to a vitiated atmosphere:

1. From the smell of the fumes.
2. From some immediate distress in breathing and a choking feeling.
3. From a feeling of faintness.

We have had no record of a case being immediately overpowered, [illegible] underground as so frequently [illegible] with CO and CO₂, and there is no difficulty in effecting an escape. We wish however to lay great stress on this point, that the initial distress is not so marked as to give a danger signal to effect an escape as soon as possible. As the period of exposure required to [illegible] produce serious poisoning [illegible] must be trained to recognise [illegible] fumes and to appreciate their intensely poisonous nature. [illegible] there must serious symptoms [illegible] the patient was present in a [illegible] for less than ten minutes, and Dr. [illegible] has recorded a fatal case [illegible] for two minutes.

[illegible] removed to fresh [illegible] in some cases to [illegible] symptoms [illegible] intensely [illegible] difficulty in getting [illegible] breathing [illegible] cough [illegible] expectoration of [illegible] With [illegible] complete collapse. The symptoms are those of an intensely acute irritant [illegible] of the lungs [illegible] death [illegible] place [illegible] hours [illegible] eight [illegible] water-logging of the lungs [illegible] sudden heart failure.

The [illegible] nature of poisoning by this gas is illustrated by [illegible] history of native [illegible] It has been [illegible] attention is paid to the amount of gassing they are subjected to [illegible] suffering from that they are allowed to go to the compounds without any medical assistance [illegible] found dead [illegible] morning [illegible]

We have [illegible] reason to [illegible] that many of the reported pneumonias which contribute so largely to underground native mortality may have been [illegible] in this manner.

This delay in the development of the symptoms of poisoning by nitrous fumes suggests the first rules we would lay down for systematic adoption in every case of gassing.

SUGGESTED RULES FOR USE IN CASES OF GASSING.

Every case of gassing must at once be reported by the observer to the shift boss [illegible] to be reported to the manager [illegible] or [illegible] captain. There should be no relaxation of the rule allowed on any [illegible] in any case [illegible] trivial.

[illegible] must immediately be [illegible] to fresh air, and at the same time the [illegible] must be sent for.

All cases white and native must [illegible] observation. Native cases should [illegible] sent to the compound hospital and there [illegible] kept under observation for at least [illegible] should be the rule no matter how slight [illegible] symptoms. White men should [illegible] kept under the observation of the [illegible] the same term.

It would be easy to multiply cases [illegible] of the importance of this rule, but [illegible] In [illegible] instance with which we [illegible] the history is very precise, the gassing occurred at 3.10 p.m., when two white men and three natives were gassed under the following circumstances. [illegible] end of a drive, at right angles to which 100 ft. or [illegible] cross-cut [illegible] working in the cross-cut [illegible] the men at the end of the [illegible] These latter were thus [illegible] by the gases [illegible] they described [illegible] gassed [illegible] turned on the full pressure of the compressed air to give them fresh air. They had no difficulty [illegible] the air [illegible] in making their way to the surface, apparently none the worse for their recent experience. [illegible] changed and proceeded to [illegible] for their evening meal [illegible] Thereafter they retired [illegible] to their rooms. Urgent symptoms [illegible] seven hours after the inhalation of the gas. They were seen at 11 p.m. and were then so ill that there were serious doubts as to the possibility of removing them with safety to the [illegible] hospital less than [illegible] yards away.

The three natives who [illegible] to the surface at the same time, proceeded to the compound, where they had their evening meal between 5 and 6 p.m., thereafter retiring to their quarters. It was not reported that they had been gassed; and nothing was known about them till next morning. When the morning shift was being turned out between 5 and 6 a.m., one was found dead, one moribund, and the third very ill and in great distress.

In another of our cases the gassing, also as in the above cases, from nitrous fumes, occurred on Friday night. He was brought to the hospital, moribund, about 12.30 on Sunday morning. He was very ill on the Saturday, his friends thinking he had a bad cold, which they treated in the usual mine fashion—with liberal doses of whisky. He died on Sunday evening.

TWO VENERABLE CUSTOMS CRITICISED.

Having thus emphasised the necessity for reporting cases, however trivial, and of keeping them under skilled observation, we wish, before detailing the systematic measures which should be employed in every case, to enter a protest against a practice which is only too common—that of treating cases of gassing externally with cold water, and internally with whisky.

Cold water, liberally applied, is popularly supposed to have a wonderful restorative effect in all kinds of fainting, and is on that account generally used as the readiest and easiest means to overcome the unconsciousness of the victims of gassing.

Now in any severe injury, whether one to a visible and tangible cause, as physical violence, as in ordinary surgical injuries, or to an invisible but none the less potent cause, as in gassing, one of the principal constitutional defects is the condition called "shock." Shock is characterised by three important symptoms:—

1. Weakening of the heart's action.
2. General exhaustion of the nerve centres.
3. Lowering of the body temperature.

These symptoms are present in every case of gassing, and the third—the lowering of the body temperature—is particularly noticeable, this being due, not merely to shock, but also to the fact that CO_2 and CO directly, and NO_2 indirectly, affect the oxygenation of the blood. Hence it is very obvious that any measure such as the application of cold water which will further increase shock and lower the body temperature, must be carefully avoided, and that, on the contrary, every effort must be made to maintain and raise the body temperature. All cases of gassing must therefore be immediately taken to a warm place if at hand, and kept warm by the application of warm clothing and other external means.

The immediate administration of whisky or brandy we also deprecate. It has been clearly proved by Mummery (Hunterian Lectures, 1905), that alcohol increases surgical shock, and the physiology of shock being the same, whatever its cause, it is certain that it will do the same in shock from gassing.

The necessity of giving this warning against these two venerable customs (which have the authority of nearly every text book) has been frequently impressed on us. Here, again, it would be easy to multiply instances, but one will make our point abundantly clear. One night on one of our mines a white miner and three natives were badly gassed, the chief poison being CO. The natives were overpowered first, and the white man, as he fortunately always does, heroically dragged them out of the danger zone, being himself ultimately overpowered. They were all rescued and brought to the surface. When the medical officer arrived he found them lying in an open shed unconscious, with the misguided but anxious and well-meaning friends treating them liberally with douches of cold water and attempting to force whisky down their throats. It was a bitterly cold winter night, and anything better calculated to increase the shock from which they were suffering, and in the event of their having inhaled any NO_2 the risk of pulmonary trouble, it is difficult to imagine. A warm engine room was quite close to the shaft, to which the victims could quite easily have been carried.

It is also no uncommon experience to find the subjects of poisoning by nitrous fumes who have been under the solicitous care of their friends for several hours, brought to the hospital in an advanced alcoholic condition. In these cases it may safely be said that there is certain death in the bottle.

IMMEDIATE STEPS TO BE TAKEN.

The immediate steps to be taken in a case of gassing are as follows:—

(*a*) In every case of gassing where the act of swallowing is voluntarily possible, an emetic should be at once administered, and for this purpose we recommend that at every shaft, a solution of sulphate of zinc containing thirty grains to the ounce, should be kept. This is to be administered in ounce doses every ten minutes until emesis is produced. The advantage of emptying the stomach and of emptying the lungs of mucus, and of any unabsorbed gas in their ultimate recesses, which the act of vomiting does more effectively than any voluntary effort, more than counterbalances the momentary depressing effect of the emetic.

It is a common experience that natives when gassed (short of unconsciousness) always attempt to make themselves sick, and that if successful they are greatly relieved immediately afterwards.

(c) We recommend that at every pithead a supply of sal volatile (aromatic spirits of ammonia) be kept, and that a dose of two drachms—two teaspoonfuls in water—be given to every patient who can swallow, immediately after the completion of the preceding manœuvre. Ammonia is the only defensible stimulant. It acts more quickly than alcohol, and has chemical reasons in its favour as well.

(d) At every pithead, or at the mine or compound hospitals where these are within reasonable distance of the shaft, there should be kept two cylinders of oxygen with masks. Oxygen should be administered in every severe case of gassing, and where artificial respiration is required this should be performed in an oxygenated atmosphere. Mine officials should be trained in the proper and economical use of this simple apparatus. The remarks we made about unduly opening the air valves of respiration apparatus apply equally here.

The value of O in poisoning by gases has been abundantly proved. Perhaps in no case is its beneficial effect more marked than in the terrible distress of the pulmonary œdema nitrous fumes poisoning. Again it has been found that CO, which has a very strong hold on the Hb of the blood, is eliminated five times as rapidly in an atmosphere of O_2 as in air. The exhibition therefore in a concentrated form of this elixir of life not only hastens immediate recovery, but largely helps to obviate the remote ill effects of carbon monoxide poisoning.

(d) In every case of gassing which is so profound as to cause deep coma and arrest of the respiration, artificial respiration must be started immediately and persevered with so long as there are any indications of life. There must be no delay in thinking of or trying other measures. It must be remembered that resuscitation is possible long after the stage of insensibility.

Great patience is required in performing artificial respiration, and it should not be discontinued for an hour if there are any hopes of life. So long as the heart continues to beat, however feebly, there is always hope of resuscitation.

(e) Poisoning by nitrous fumes, which is much more common in our mines than is generally supposed, and which is caused by contact with an atmosphere vitiated by the products of the combustion or incomplete detonation of nitro-glycerine explosives has its symptoms so long delayed that the treatment of its chief symptons falls entirely to the medical officer. But we again repeat our warning about the insidious nature of this poison and the consequent necessity of keeping every case of gassing under observation. The initial measures we have recommended should not be omitted in this case also.

For the immediate treatment of authenticated cases a method originated and devised by a distinguished member of the Chemical, Metallurgical and Mining Society of South Africa has attained to some notoriety; we mean the chloroform method of Mr. Weiskopf. So little was previously known of the proper way of treating these cases that Mr. Weiskopf's method came to be readily adopted both on the Continent of Europe and we find also in America. Mr. Weiskopf calls his treatment the chloroform antidote method. This however is a misnomer, because it lays stress on the least important element in his mixture. The mixture, which he recommends, consists of equal parts (eight drops) of chloroform and strong ammonia in water to be given in frequent doses. For the suggestion to immediately use ammonia, and also for his suggestion to employ as soon as possible an alkaline spray for inhalation he deserves the greatest credit, for ammonia has strong chemical and physiological reasons in its favour. But chloroform possesses neither chemical, physiological nor pharmacological properties to recommend it as an antidote to poisoning by nitroso-nitric acids.

The manner in which the chloroform is supposed by its advocates to act hardly recommend it to those to whom the physiological action of chloroform is familiar. Mr. Weiskopf himself says that it is well known that chloroform in small doses, acts as a distinct excitant on the heart, and the blood will be much more energetically circulated throughout the system thereby. That it has this action in the doses recommended we admit, but we maintain that ammonia is much more powerful and has none of the drawbacks of chloroform. On the other hand we find Dr. Seyffert, of Troisdorf, ascribing the supposed beneficial action of chloroform to its well known power to inhibit or at least to decrease convulsive conditions or conditions of reflex irritability. Convulsions are said to occasionally occur after the inhalation of nitroso-nitric acid vapours, and are explained by Dr. Seyffert as a reflex effect of the inhaled vapours upon its smallest sensory nerve endings in the respiratory tract. If these convulsions affect the heart, lung or diaphragm or if long continued, death may ensue.'

The beneficial action of chloroform is supposed to be in inhibiting or decreasing these. In the first place, convulsions have not been observed by us in a considerable experience of these cases. Convulsions very frequently precede death from various causes, and it is possible that in explosives factories, where large quantities of concentrated vapours may be inhaled, producing rapidly fatal asphyxia, convulsions may occur. To subdue these the administration of chloroform would have to be pushed to the stage of profound anaesthesia, which is clearly not the intention of the internal doses recommended.

The danger in nitrous fumes poisoning, as occurring in mines, is the irritant inflammation of the lungs, which is the characteristic clinical feature and the invariable cause of death. The exhibition of a remedy which would in any way tend to diminish the already weakened expulsive power of the water-logged lungs would, in such circumstances, only aggravate the mischief. One can only suppose that the amount of chloroform in Mr. Weiskopf's mixture is not sufficient to produce this result.

To our mind the proper treatment of nitrous fumes poisoning is the immediate and repeated administration of ammonia (in the form of sal volatile, as already recommended), acting both as an antidote and a stimulant. Shock may have to be counteracted by saline transfusions; and should the symptoms of the irritant inflammation of the lungs supervene, venesection and liberal blood-letting may have to be performed, and oxygen inhalations employed in conjunction with the above remedies. But these fall within the province of the medical officer.

Finally, in our opinion, a knowledge of these simple safety measures should be required of all managers and overseers, be embodied in the mining regulations, and form part of the State examination.

From a paper read before the Chemical, Metallurgical and Mining Society of South Africa.

NEWS ITEMS.

Tramways and Light Railways Association.

The members of the Association paid an official visit to the Kingsway subways on January 8th, including the shallow subway for tramways and the pipe subways which carry the gas, water and electric mains. The visitors were received by Mr. A. L. C. Fell, Chief Officer L.C.C. Tramways, and Mr. W. R. Morris, M.Inst.C.E., the resident engineer, and conveyed by special car to the Southampton row end of the subway, where the pipe subway was entered and inspected from end to end. The subways have been so recently dealt with that further reference to them is unnecessary, but the new type of steel car specially constructed for the service by the Electric Car Company of Preston may be briefly described. The car is of the single-deck bogie type, with underframe of steel angle and channel sections. The side and end framing is formed of a combination of angle and H sections, secured to the sills with rolled steel angles cut to suit, and riveted to the posts and sills. Cant rails and garnish rails run the whole length of the car in one piece and are riveted to the posts, the joints being strengthened by gusset-plates. The fender rails run the whole length of the car, but are divided to admit of the panels being removed in sections. The roof frames are composed of Z and L steel sections covered with steel panels. The inside finish is entirely of aluminium. The compartment doors of the twin type are of steel plate, and fitted with a simultaneous working device. A special feature of the cars is the interchangeability of the various parts, but whether this will prove an advantage in maintenance is not yet certain. The seats of oak slats are rendered non-flammable. The car body is mounted on a centre bearing minimum traction truck of the Mountain and Gibson type with steel tyred wheels.

The Andrew Carnegie Research Scholarship.

We are reminded that prospective candidates for the Andrew Carnegie Research Scholarship must apply on a special form before the end of February to the Secretary of the Iron and Steel Institute. It will be remembered that the object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school, or works, provided it be properly equipped for the prosecution of metallurgical investigations. The results of the research are communicated to the Iron and Steel Institute in the form of a paper submitted to the annual general meeting, and if the Council consider the paper to be of sufficient merit, the Andrew Carnegie gold medal is awarded to its author.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts

CONTRACTS OPEN.

Last Day.

Dundee.—Supply and delivery of retorts and fireclay goods to such extent as they may require for period ending February 28th, 1907, for the Dundee Gas Commissioners. Mr. Alex. Yuill, gas engineer, Gasworks, Dundee ... ... Jan. 16

Lambeth, S.E. — Rebuilding a pair of horizontal engines at the Renfrew Road Workhouse, including new 15-in. cylinders, pistons, connecting-rods, etc., and turning up a 10 ft. flywheel. Mr. George E. Arnold, 26, Victoria Street, Westminster, S.W. ... . Jan. 16

Nelson. — Construction of an inclined retort stack (36 mouthpieces) with all hydraulic mains, stage floors, coal conveyors, charging apparatus, etc., in the existing retort house at their Brierfield works, for the Gas Committee. Mr. A. J. Hope, engineer, Gas Offices, Nelson. Jan. 17

Swansea.—Extending seaward the existing West Pier, for the Swansea Harbour Trustees. The extension to be either for 800 ft., 1,000 ft., 1,200 ft. or 1,400 ft. as the Trustees may determine. Mr. A. O. Schenk, M.Inst.C.E., Engineer's Office, Swansea ... ... Jan. 18.

Leyton, (Essex). — For the following plant: (1) 500 k.w. dynamos, (2) overhead crane, for the Electric Lighting Committee of the Leyton Urban District Council. Mr. F. Harman Lewis, electrical engineer, Cathall Road, Leytonstone ... ... Jan. 18

Stratford-upon-Avon.—Manufacture delivery, and erection of three sets of gas or oil engines and pumps, for the Corporation. Messrs. Willcox and Raikes, Union Chambers, 63, Temple Row, Birmingham ... ... Jan.

Wimbledon.—Supply and fixing of air compressors, to be electrically driven, at the pumping station, Durnsford-road, Wimbledon, for the Wimbledon Corporation. Mr. C. H. Cooper, M.Inst.C.E., Town Hall, Wimbledon ... ... Jan. 22

King's Norton.—About 1,200 yards of wrought-iron railing for enclosing recreation ground in Franklin Road, King's Norton, for the King's Norton and Northfield Urban District Council. Mr. Ambrose W. Cross, A.M.Inst.C.E., 23, Valentine Road, King's Heath... ... . Jan. 22

London, E.—Reconstruction of a swing-bridge carrying Old Gravel Lane over the entrance to the East London Dock, in the metropolitan borough of Stepney, for the London County Council. Mr. Maurice Fitzmaurice, C.M.G., County Hall, Spring Gardens, S.W. ... Jan 23

Last Day

Great Northern Railway.—Construction of Contract No. 1 from Enfield to Cuffley, being a length of five miles or thereabouts, for the Great Northern Railway Company. Engineer of the Company, King's Cross Station, London, N. ... ... Jan. 23

Huddersfield.—The following works, for the Corporation—viz: (Contract No 1) intercepting sewer, sedimentation tanks, detritus tanks, bacteria beds and other works contingent thereon; (Contract No. 2) gas-plants, gas-engines, generators, air-compressors and motors, pumps and motors, sludge pumps, switchboard, etc.; (Contract No. 3) sewage screen and elevator; (Contract No. 4) sewage discharge recorder; (Contract No. 5) sewage distributors and cables. Mr. K. F. Campbell, Engineer to the Corporation ... ... Jan. 27

Arkley (Herts).—Covered service reservoir capable of holding about two million gallons, to be constructed on the company's land at Arkley, Hertfordshire, for the Barnet District Gas and Water Company. Mr. T. H. Martin, A.M.Inst. C.E., engineer and manager, Station Road, New Barnet ... ... Feb. 2

COMING CONTRACTS.

Clayton West.—The Clayton West and Darton Light Railway Co. propose to construct a light railway (4 ft. 8½ in. in gauge) from the terminus of the Lancashire and Yorkshire Railway at Clayton West to Darton Station on the Wakefield and Barnsley line of the Lancashire and Yorkshire Railway Company.

New Mills.—The gas manager's estimate of £5,000 for gasworks extensions has been approved.

Coventry.—The Town Council have just decided to expend a further sum of £5,000 for the purchase of electric motors to be let out on hire.

Bridlington.—An inquiry has been held into an application of the Town Council to borrow an extra £6,000 for electric lighting purposes. The Rural District Council are raising £3,750 for the Flamborough waterworks.

Bolton.—It is understood that the Corporation intend proceeding with the making of new waterworks. The cost will run well into six figures at no distant date. The undertaking will be one of the most important taken in hand locally for some years past.

Canadian Railways.—It is stated that the contract for the construction of 244 miles of the Government section of the Grand Trunk Pacific Railway between Winnipeg and Lake Superior will be let at the end of this month.

Hindley. — The South Lancs. Tramways Company is about to extend its lines from Hindley through Hart Common, Westhougton, to Deane

CONTRACTS CLOSED.

Peterborough. — The Holwell Iron Company, Ltd., Melton Mowbray, has received the contract for the cast-iron pipes, cylinders for pump well, and fittings in connection with the Etton Extension Corporation Waterworks for Peterborough.

Dumbarton.—Messrs. Babcock and Wilcox, Glasgow, London, etc., have received an order from Messrs. Kosmoid, Ltd., for 28 large boilers for their Dumbarton works.

Croydon.—The Croydon Town Council have accepted the tender of the British Thomson Houston Company, Ltd., for a three-machine motor generator.

Chile.—The tender of the Chilian syndicate for the construction of the railway between Arica and La Faz being £467,000 lower than the tender of the English group and £200,000 lower than other tenders, the contract (Reuter states) will be given to the Chilian syndicate.

Wolverhampton.—Messrs. Bailey, Pegg, and Co., Brierley Hill, have secured the contract from the Wolverhampton Council for 3-in. pipes.

Bristol.—Messrs. Tangye, Birmingham, are supplying the pumping machinery for emptying the new graving dock at Bristol.

Admiralty.—The contract for the turbine machinery of the *Dreadnought* has been given to Messrs. Vickers, Sons, and Maxim. The boring out of the four propeller shaft brackets is now proceeding.

L. & S. W. Railway.—One of the two vessels required by the London and South-Western Railway Company for the service between Southampton and Jersey is to be built by Messrs. Vickers, Sons, and Maxim, of Sheffield and Barrow-in-Furness, and the other by Messrs. Gourlay Brothers and Co., of Dundee.

London.—The Brush Electrical Engineering Co., Ltd., have received the following contracts: Croydon, per B. E. T. Co., booster set; Bournemouth Corporation, five cars with Brush trucks and Westinghouse equipments; Swindon, three cars complete with radial trucks and Brush equipments; Wimbledon U. D. C., two electric pumping sets; Port Glasgow Tramways Co., Greenock, three cars complete with radial trucks and Brush motor equipments; Neumann and Co., South Africa, three 50 k.w. transformers.

Bridlington.—The Town Council have accepted the tender of the General Electric Co. (1900), of Witton, amounting to £1,315 2s. for electricity extension works.

Southport.—The Corporation have accepted the tender of the Lancashire Dynamo and Motor Co., for automatic reversible motor-driven booster (Turnbull and McLeod patent) and switchboard.

Pontypridd.—The Corporation have accepted the tender of the Lancashire Dynamo and Motor Co. for one three-wire automatic reversible booster for traction and lighting.

Llandrindod Wells.—The Llandrindod Wells Electric Light and Power Co. have given a contract for one 350 k.w. generator for direct coupling to Howden engine to the Lancashire Dynamo and Motor Co., Trafford Park, Manchester.

Newcastle-on-Tyne.—Messrs. Davidson and Co., Ltd., of Belfast, have awarded the contract for the supply of three 70-in. Sirocco centrifugal fans for induced draft, in connection with the new boiler plant of the Carville Power Station Extensions of the Newcastle-on-Tyne Electric Supply Co., Ltd. Each of the fans will be direct-connected to an alternating current motor, and will deal with 170,000 cubic feet of flue gases per minute.

APPOINTMENTS VACANT.

Newcastle.—A lecturer in physics is required at Armstrong College, Newcastle-on-Tyne. Salary £200, rising by annual increments of £10 to £250... ... ... Jan. 13

Bradford.—The Corporation invite applications for the appointment of three engineering assistants in the sewage works, Engineer's Department, at a salary of £150 per annum each. Frederick Stevens, town clerk ... ... Jan. 16

London.—The London General Omnibus Company require an experienced engineer to manage their various garages and to superintend all the engineering work therein. Secretary, 6, Finsbury Square, London ... ... Jan. 17

Aberdeen.—The Town Council have decided to appoint a general manager, at £300 per annum, to take charge of the tramway undertaking, including rolling stock, but exclusive of electrical and mechanical equipment and permanent way ... ... Jan. 20

London.—Directors of the Burma Railway Co. invite applications for appointment as temporary assistant engineer in the way and works department in Burma. Salary, up to Rs. 400 per mensem. Mr. A. G. Begbie, managing director, 199, Gresham House, Old Broad Street, London, E.C. ... Jan. 24

Auckland, New Zealand.—Applications are invited for the appointment of City Engineer to the City of Auckland. High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W. ... ... Feb. 8

APPOINTMENTS FILLED.

Dartford.—Mr. Arthur Murdock, superintendent at the Blackpool Electricity Works, has been appointed general manager and engineer to the Dartford (Kent) Light Railway Co.

British Fire Prevention Committee.—At a meeting of the British Fire Prevention Committee on December 20th, Mr. W. Noble Twelvetrees, M.I.Mech.E., A.M.I.E.E., was elected a member of the executive vice Mr. Lionel J. Langridge, A.M.I.E.E., and was at the same time nominated to serve on the General Testing Arrangements (Standing) Sub-Committee.

Preston.—The Council have unanimously appointed Mr. J. F. Simpson, who has acted as chief assistant, to succeed Mr. Tiltensor as borough electrical engineer and tramways manager at a salary of £300 per annum.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: Feb. 1st. General Settlements: Jan. 25th; Feb 8th, 22nd. Bank Rate, September 28th, 1905, 4 per cent.

1.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¼— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅞ — 4¼
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 1/16 - 3 3/16
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5 — 5½
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	101—103*
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt Debs. Red.	100	94 - 97*
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord. ..	1	3¾- 4
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 1/16—1 3/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6⅜d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 1/16 -1 3/16
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101—103*
150,000	4½	3/-	Barrow Hæmatite Steel Co., Ld., O.	4½	5 — 5¼
50,000	4½	3/	Do. do. Cum 2nd. Pref.	4½	5 — 5¼
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	102½- 104½
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12¾—13¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99—101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅞ —1⅛
300,000	1	6⅜d.	Do. 5½% Cum Pref.	1	11/16— 13/16
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	91—94*
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1⅛—1 3/16
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅜—1½
590,000	1	6d,	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅞ 2
74,000	10	5/-	Do. 5% Cum. Pref.	10	11¾—12¼
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	10¼ - 10¾
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5½— 5¾
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible]
70,000	5	2/6	Do. 5% Cum. Pref	5	5⅛ — 5⅝
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	99 —101*
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	35½ —36½
57 031	10	10/-	Crossley, Bros , Ld , Ord. 40340/97370	10	15½ —15¾
40,339	10	5%	Do 5% Cum Pref.	10	11½—11¾
75,000	1	2 6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	⅞ 1 1/16
£400 000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk	100	92—95
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3¾— 4¼
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	[illegible]
300,000	1	7⅛d.	Do. 6% Cum. Pref. ..	1	[illegible]
4,721	13	13	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	10½— 11½
69,754	13	10/-	Do. do. do.	10	9—9½
20,250	10	8/-	Elliott's Metal, Ltd.	8	5 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8½— 9*
186,748	Stk	4%	Do. Deb. 4%	100	93 —95*
25,000	10	6/-	Fairfield Shipbuilding & Engng.Co., Ltd., 6% Cum. Pref. ..	10	11½— 12
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
126,000	3	2/4½	Fraser & Chalmers, Ltd., Ord. ..	3	3¾— 4¼
21,000	3	1 6	Do. 7½% Cum. Pref.	3	5¾— 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	7½—7¾*
£150,000	Stk	4%	Do 4% 1st Mort Deb Red..	100	86 -87*
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	6½— 7
9,600	10	7%	Do. 7% Cum. Pref.	10	10½ 11½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	[illegible]
344,000	5	2/6	Do. 5% Cum. Pref.	5	6⅜ 6⅝
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	104—106*
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2¾ — 3¼
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3¾—4
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ - 11*
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	4¾— 5¼
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	⅞— 1
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	98—100
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5½— 6
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	[illegible]
18,000	5	3/-	Do. 6% Cum. Pref.	5	5 — 5½
£100 000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	100—103

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend.	Name	Paid up	Closing Prices.
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1½ -1⅝*
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¼ 12¾*
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	96 —99*
37,500	10	20	Kynoch, Ltd.	10	18¼—18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅜—10⅞
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝—⅞
50,000	5	2/9	Do. 5½% Cum. Pref	5	4 — 4½*
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	4 - 4½
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1⅜ -1½
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110*
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11¾
210,000	1	8⅜d.	Measures Bros., Ltd., Ord.	1	[illegible]
75,000	1	6⅜d.	Do. 5½% Cum. Pref.	1	1 — 1⅛
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	98 — 101
21,943	5	2/6	Muntz Metal, Ltd.	5	4¾— 5¼
14,248	5	5%	Do. Pref. 5%	5	4¾— 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅜—12⅝
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db Stk., Red.	100	87 — 91*
122,000	5	1 6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	4½— 5⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6 — 6½
70,000	10	10/-	Pease & Partners, Ltd., Ord. ..	10	13¼—13¾
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	99—102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	4⅞— 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	0/6—10/9
13,000	5	—	Do. 5½% Cum Pref.	5	4⅝— 4⅞
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	[illegible]
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	2 — 2½
73,062	5	2/-	Do. New	5	1 1/16— 1 3/16
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99—101*
350,000	1	1/2⅖	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	[illegible] — 1
£350,000	1	7½	Do. 6% Cum. Pref.	1	[illegible] - 1 1/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	100—102*
35,000	10	12/-	Ruston, Proctor & Co., Ltd... .	10	10½— 11
275 000	1	6d.	Scott (Walter) Ltd., Ord.	1	[illegible]
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1 —1 1/16
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	92 —95*
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red ..	100	92 — 95*
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	96 —100*
250 000	1	1/-	South Durham Steel & Iron, Ltd.Or.	1	1 — 1 1/16
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	15/16 —1 1/16
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	93 — 96*
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2¼— 3
25 000	10	5/6	Do. 5½% Cum. Pref. ..	10	5½— 6
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	81— 84*
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	18¾— 19¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½— 15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅞ —15/16
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16 —1 1/16
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb Stk. Red	100	96 — 99*
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum.Pf.	1	9/16 —11/16
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80 — 84
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd.Or.	1	¾ - ⅞
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	⅞ — 1
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum.Pf.	10	9 — 9½*
$508495200	$100	$½	United States Steel Corp. Com.Stk.	$100	45⅜—45⅝
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	110 —110½
$162268000	$1000	5%	Do. 10-60 yr. 5% Skg.Fd.G.Bds.	$1000	100—102
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 11/16— 2 13/16
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 1/16— 1 3/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	106	121 —124
£1,250,000	Stk	4%	Do. 4% 1st.Mort.Deb.Stk.Red.	100	103 —105
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	104 -106
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	1 3/32— 1 5/32
500,000	1	7⅕d	Do. 6% Cum. Pref. Ord. ..	1	1⅛— 1 3/16
£300,000	Stk	4%	Do. 4% Perpetual Deb.Stock	100	92 — 95
66,666	5	3/.	Willans & Robinson, Ord.	5	1¾— 2¼
66,666	5	3/-	Do. 6% Cum. Pref.	5	3½— 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	82 — 87
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	10	77 —79

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝– ⅞
125,000	1	7⅕d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	½– ⅝
120,000	1	1/2⅖	Bell's Asbestos Co., Ltd.	1	1½–1⅝
£40,000	5	9d	British Aluminium Co. 7% Cum Pref.	5	5½– 6
£300,000	Stk	5%	Do 5% 1st Mort. Deb. Stk. Rd.	100	98 –102
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	6½– 7
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¾– 6¼
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	103 –106*
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	98–100
400,000	5	8/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	1¾– 2¼
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	78 – 83*
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	¼– ½
150,000	2	2/4⅘	Do. 6% Pref.	2	1¼– 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	96 –100
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	82 – 84*
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 – 12
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅝– 5⅞*
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	107 –109*
85,000	3	1/6	Crompton & Co., Ltd...	3	2 – 2¼
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95 – 98%*
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8¾– 9¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5¾– 6¼
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	104 –106*
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛– 1⅜*
£233,334	Stk	4%	Do. 1st Mort. 4% Free. Deb. Stk.	100	106 –109*
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅜– 1⅝
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2¼– 2¾
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	86 – 88*
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	92 – 97
112,100	2	1/7⅕	Electric Construction Co., Ltd. ..	2	½ – ¾
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	1⅞– 2⅛
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 – 95
10,248	10	7/6	Evered and Co., Ltd....	10	9 – 11
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9 – 9½*
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	96–100
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12½–13½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5¼– 5½
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	—
50,000	10	15/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	18 – 19*
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 –102
7,500	10	—	Parker, Thos., Ltd.	10	6½– 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	17/3 - 17/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	33 – 35
150,000	100	4%	Do. 4% Deb. Bonds	100	100–102*

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼– 8¾
260,007	5	2/9	Do. 5% Cum Pf.	5	5¾– 6*
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 –143*
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13¾– 14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½– 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98 –101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 –102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅝–¾
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16–1 1/16*
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1 – 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾– 4⅛
£425,000	Stk	4½%	Do 4½% 1st Deb. Stk., Red.	100	93 – 96*
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	120–123
		5%	Pref. Ord. Stock	100	109–112
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8⅝–8⅞
156,437	10	6/-	Do. 6% Cum. Pref.	10	10½– 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	119 –121
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98–100%
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¼– 3⅝
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5¼ – 6
27,000	5	3/-	Do. "B" do.	5	5 – 5½
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96–98*
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	100—104

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9¼–9¾
£350,000	Stk	4%	Do. 4½% 1st Deb. Stk., Red.	100	104 –106*
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	⅞ –1⅛
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞–5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101–104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	102–104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½–14½
59,987	10	6/-	Do. 6% Pref...	10	14½–15½
£125,000	Stk	4½	Hastings & Dist. Elec. Trams. Co., Ltd., 4% Deb Stock, Red. ..	100	101 103
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¼– 2¾
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	82 – 87*
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9½–10*
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 –101*
60,007	1	1/-	London Motor Omnibus Co., Ltd., Ord. No. 1—60,007	1	1¾–2*
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 –103*
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	7/32 – 9/32
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 –1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 –106*
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½– 1½
110,923	8	2/9⅗	North Metropolitan Tramways Co..	8	4 – 4½
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	92 – 97
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103 –106*
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾– 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¾– 10¼
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103 –106
£160,000	Stk	5%	Sunderland Dist. Elec. Trams. Ltd., 5% 1st Mort. Deb. Red... ..	100	92–97*
£275,000	Stk	4½%	Yorkshire (W. Riding) Elec. Trams. Co., Ltd., 4½% 1st Deb. Stk., Red.	100	94 –96

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares	Last Dividend.	Name.	Paid up.	Closing Prices
7 500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12⅜– 12⅞
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10¼–10¾
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11¾– 12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 –107*
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼– 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	102 –10[illegible]
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	8¾– 9¼
12,493	5	3/3	Do. 7% Cum. Pref. Shares..	5	9 – 9½
60,000	5	3/3	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	8¾– 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	102 –105
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	5¾ – 6¼
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼– 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 –103
41,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	5 – 6
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 –110*
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11 - 12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¼ – 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122 –126*
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	101 – 105*
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½ – 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12¼ – 12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	110 –113*
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¼ – 5¾
70,000	5	3/-	Do. 6% Cum. Pref.	5	5¾ – 6
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90*
19,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd... .	10	9 — 10
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	8¼ – 8¾
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅞— 1
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	10¼ –11¼

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 –103
111,000	3	1 9¾	London Elec. Supply Corp., Ld., Ord.	3	1¾ 2¼
60,000	5	8/-	Do. 6% Pref.	5	5 – 5¼
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	98 101
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9½–10½
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5¼– 5½
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	107 –111
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	95 97*
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99 -101%*
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	13¾ – 14¾
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 -100
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6½ – 6¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	100 –102
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 –103
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	12½–13½
20,000	5	3/6	Do. 7% Pref.	5	7½ – 8½
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 – 99*
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2 – 2½
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	76 – 86
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3 – 3½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 – 15/16
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 5/16–1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 –108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅝ – 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5 – 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	105 –107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½–12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	98½–101½*
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	3¾– 4¼
£763,580	Stk	14/-	Anglo-American Tel. Co., Ltd., Ord.	100	63 – 65
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	110 –111
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	17½– 17¾
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7¾– 8¼
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	98 –100*
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½– 9
6,000	10	10/-	Do. 10% Preference ..	10	17 –18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜– 3⅝
		5/-	10% Cum. Preference	5	8¼ - 8¾
£30,000	50	4½%	Do. 4½% Debs...	50	99-102%*
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	14 –15
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	91 –101*
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	101 –103
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101 -103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½–14¾
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106½ -108½
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	146 –149
£2,000,000	Stk	17/6	Do. 3½% Pref.	100	91 –93
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106½ 108½
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	37 – 39
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	98 –101*
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	67 –59
£251,127	1		Marconi's Wireless Tel. Co, Ltd. ..	1	1⅛–1¼
72,080	1	9½d.	Monte Video Telephone Co., Ltd., O.	1	⅞ 1
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	111½ –112½
£1,966 667	Stk	5%	Do. Deferred	100	110½ 111½
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅜ - 5⅝
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	98½ -100½*
£689,593	Stk	4%	Do. 4% do. do. ..	100	103 –105*
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ – 1½
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1¼ –1⅜
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 –102*
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼– 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7¼ – 7½*
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½– 5¾*
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	110 –112*
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	9½ 10
£30,008	2½	—	West Coast of America, Ltd. ..	2½	9/16 11/16
£100,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99½ - 101*

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½– ¾
34,568	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼– 8¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½ 7½
£80,000	100	5%	Do. 5% Deb.	100	100–103*
207,990	10	3/-	Western Telegraph Co., Ltd. ..	10	14 –14½
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 –102*
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	101½–103½*

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9¼– 9¾
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100–102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	97 – 99*
10,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6¼– 6¾
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	——
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	97 – 99
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13½– 14
40,000	20	8/-	Do. Nos. 60,001-100,000	10	6¼– 6¾
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102–104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1½ – 1⅝
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 – 5½
36,758	8	4/9¼	Do. Non-Cum. 6% Pref.	8	8¾ – 9¼
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 – 99
55,000	5	1 3	Houlder Line, Ltd., Ord.	5	1 – 2
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾– 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 – 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref ..	10	5½ - 6
20,349	10	5/-	Orient Stm. Nav. Co. Ltd., Pref Nos. 1-20,349 ..	10	7 – 7½
£103,100	Stk	4%	Do. 4% Deb. Stk., Red. ..	100	87 90*
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126–129
£1,160,000	Stk	19%	Do. do Deferred ..	100	238 -241
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	48 – 50
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾– 5¼
39,075	5	2/6	Do. "B" Ord.	5	3¾– 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼– 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10½– 11*
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 –101*

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices
60,000	1	9½d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 –1¼
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	121 –126
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	26 – 28
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 – 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ – ⅜
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜– ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 –1 3/16
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛ –1½

RAILWAY CARRIAGE & WAGON COMPANIES.

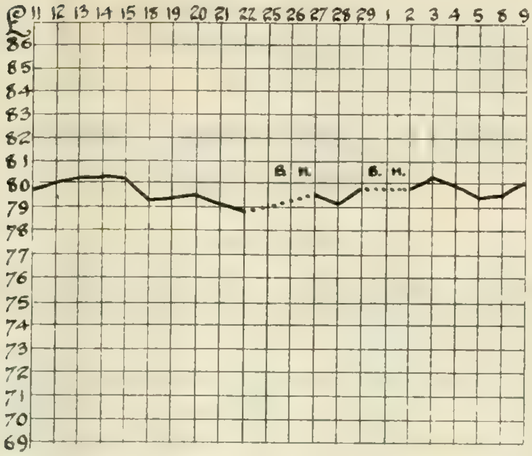
Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	26 – 26½
8,739	10	3/-	Do. Second Issue 1-8,739....	4	9¾–10
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾–14¼
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	10⅝– 10⅞
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 7/16– 4 11/16
14,567	10	1/3	Lancashire Wagon, Ord.	2	2¼ - 2¾
4,150	10	5%	Do. do.	10	10⅜ – 10⅞
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/6 - 44/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/- —25/-
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6—29/6
20,000	20	20/-	Midland Rail.-Car & Wagon, Ld., 1-20,000	10	20¾— 21¼

Stocks and Shares marked * are quoted ex dividend.

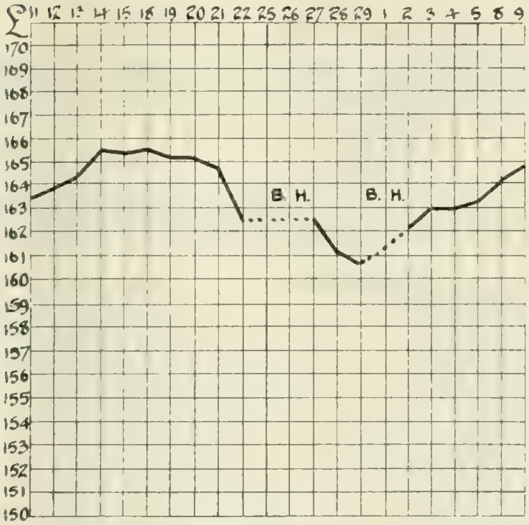
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM DECEMBER 11TH, 1905, TO JANUARY 9TH, 1906.

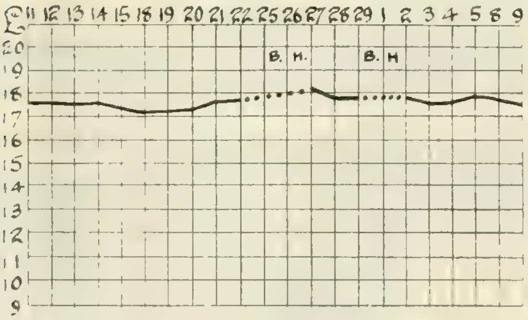
COPPER.



TIN.



ENGLISH LEAD.



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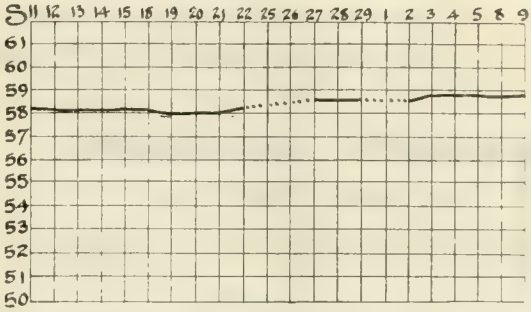

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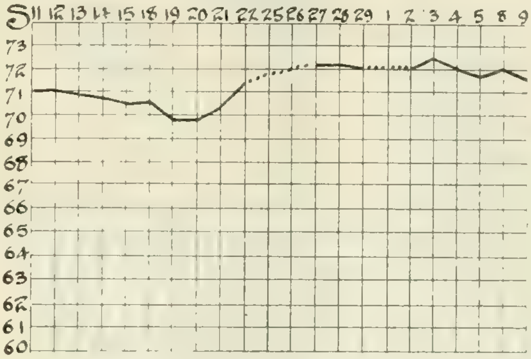
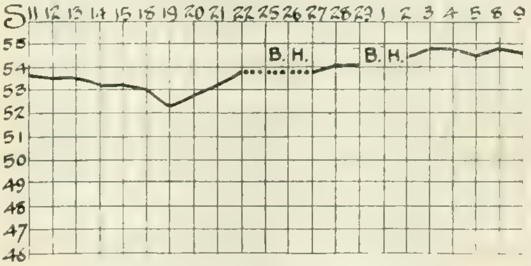
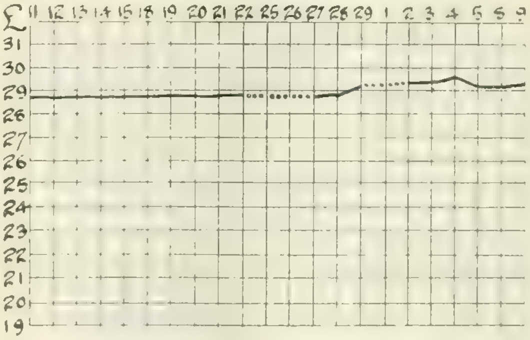


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, January 10th, 1906.

ONLY moderate activity has prevailed in the copper market since the holidays, and during the past day or two dealings have been somewhat checked by the reaction in the share market, but the decline in prices is probably temporary, as a very brisk trade is reported with consumers in almost all countries. The fortnightly statistics show the supplies at 10,889 tons against 11,370 tons deliveries, so that the visible supply has decreased 481 tons, and now stands at 12,983 tons. The undertone of the market remains fairly firm, and closing prices to-day are £79 17s. 6d. cash, and £79 5s. three months.

Tin has been the subject of heavy dealings and somewhat wide fluctuations in quotations have to be recorded. The most noticeable feature of recent dealings was the re-establishment of a contango on forward metal. This was caused by the operations of dealers most prominently connected with the upward movement, who let out large quantities of cash metal. In later dealings the bears have attempted depress prices, but support has been forthcoming, and the market in its latest tendency displays renewed buoyancy at £166 cash, and £166 10s. three months.

In the Lead section the market is somewhat easier, soft foreign prompt having been sold down to under £17, but it shows some recovery from the lowest. Spelter keeps steady on good inquiries from consumers, but at £20 5s. is somewhat below the best. Zinc sheets have been good, and the demand for galvanised-iron sheets has been well maintained.

On good trade advices and sustained forward buying, the speculative iron market has been strong. At one time Cleveland ran up to 56s. 2d., but realisations ensued at this price, and later dealings have been well under the best. The statistics of the Scotch Iron Trade Association are a further proof, if such were needed, of the excellent position of the Iron trades. While the production last year has increased by 38,651 tons, the stocks in makers' yards have decreased by 66,883 tons, although stocks in Connals warehouse have increased [illegible] tons, and consumption is stated to have increased by [illegible] tons. The reports from [illegible] the [illegible] centres are very hopeful, and the [illegible] are [illegible] in all branches.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :	£	s.	d.
Siemens' Steel Plates, Marine Boiler Quality ..	8	2	6
,, ,, ,, Land ,, ,, ...	8	2	6
,, Steel Bars, Boiler Quality	8	5	0
Siemens' Steel Plates, Ship Quality Plates......	7	2	6
,, ,, Bars ,, ,, ...	7	15	0
,, ,, Angles..........	6	15	0

Manufactured Iron :

	£	s.	d.
Bars—Dalzell	7	2	6
,, Best	7	12	6
,, ,, Horseshoe	7	12	6
,, Angle..............	7	2	6
,, Best Angle	7	12	6
,, Best Best	8	2	6
,, Extra Best	8	12	6

Usual terms and extras. Special rates for delivery in England and export The above prices subject to alteration without notice

Malleable Common Bars:	£	s.	d.	
Dalzell, per ton	7	2	6	5 per cent.
Govan	6	10	0	,,
North British	6	10	0	,,
Drumpellier	6	7	6	,,
Waverley	6	10	0	,,
Crown	6	5	0	,,
Dundyvan	6	5	0	,,
Muirkirk	6	5	0	,,
Rochsolloch	6	5	0	,,
Phœnix	7	5	0	,,
Coatbridge	7	2	6	,,
Coats	6	5	0	,,
Angle Iron				,,
Steel Plates, ship		—		,,
,, Boiler Plates				,,
Rails...		.		,,
Railway Chairs		–		,,

G.M.B. at Glasgow, No. 1, 64s. ; No. 3, 61s.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	7	5	0
,, Best	7	15	0
,, Best Best	8	5	0
,, Extra Best..............	8	15	0
,, Best Horse Shoe	7	15	0
,, Extra B.H.S.	8	15	0
,, Extra Best Cable	9	5	0
,, Rivet	7	5	0
,, Best Scrap Rivet	8	5	0

	£	s.	d.
Angles—Phœnix	7	5	0
,, Best	7	15	0
,, Extra Best	8	5	0
Gas Tube Hoops—Phœnix Best	7	15	0
Plates—Phœnix		—	
,, Best Boiler	8	10	0
,, Best Best Boiler	9	0	0
,, Extra Best Boiler	10	0	0
Boiler Tube Strips—Phœnix	9	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:

	No. 1. £	s.	d.	No. 3. £	s.	d.
Coltness, f.a.s. Glasgow	3	16	0	3	6	0
Gartsherrie ,,	3	8	6	3	3	6
Summerlee ,,	3	11	0	3	6	0
Carnbroe ,,	3	5	6	3	2	6
Langloan ,,	3	10	0	3	5	0
Calder ,,	3	7	6	3	2	6
Clyde ,,	3	8	0	3	3	0
Glengarnock, f.o.b. Ardrossan	3	8	0	3	3	0
Eglinton ,, ,,	3	3	0	3	0	0
Dalmellington, ,, Ayr		—		3	0	0
Shotts ,, Leith	3	7	6	3	2	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works**:—

	£	s.	d.
W.W. ♛ Bars	7	5	0
W.W. Best Bars	7	12	6
W.W. Best Best	8	0	0
W.W. Best Best Best	8	7	6
W.W. Best Shoe	7	15	0
Thornaby ♛	8	15	0
Thornaby Best	9	5	0
Thornaby Best Best	10	5	0
Whitwell Special Admiralty Cable	10	15	0
Special Chain Iron	9	15	0
Tube and Nail Strip iron net cash	7	5	0
W.W. ♛ Angle Iron	7	7	6
W.W. Best Angle Iron	7	15	0
Tee Iron, to 8-inches United	8	5	0

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd., Dallam and Bewsey Forges, Warrington, quote as follows:—

		Iron. £	s	d.	Steel. £	s.	d.
♛ (SN)	Bars	7	10	0	7	15	0
	Angles	8	0	0	8	5	0
	Tees	8	10	0	8	15	0
♛ W.I.W	Hoops	7	10	0	8	0	0
	Sheets	8	15	0	9	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

Lots under 10 cwts. of a size 10s. per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s.	d.
"Vale"	11	0	0	12	0	0
"Shield"	11	10	0	12	10	0
"Severn"	12	10	0	13	10	0
"Baldwin Wilden B."	13	10	0	14	10	0
Charcoal	17	10	0	18	10	0
Best Charcoal	19	10	0	20	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£	s.	d.	£	s.	d.
No. 3 Lead	14	10	0	15	10	0
S.V. Lead	16	0	0	17	0	0
No. 3 Terne	16	0	0	17	0	0
S.V. Terne	17	10	0	18	10	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in. per ton. £	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	13	7	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	16	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	14	7	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	7	5	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ to 4in. rounds and squares)	7	15	0	,,
Angles	7	10	0	,,
,, Best	8	0	0	,,
T's	7	15	0	,,
,, Best	8	5	0	,,
Best Shoe Iron	7	15	0	,,
,, Rivet Iron	8	15	0	,,
,, Best Rivet (Special)	10	0	0	,,
,, Cable	10	0	0	,,
,, Screwing	9	0	0	,,

	£	s.	d.	
Best Turning	7	15	0	per ton.
,, Plating	9	0	0	,,
Best Best	10	0	0	,,
Treble Best	11	0	0	,,
Plates	8	5	0	,,
Best Plates	8	15	0	,,
,, Boiler Plates	9	5	0	,,
,, Best Boiler Plates	10	5	0	,,
Treble Best Boiler Plates	12	15	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "St[illegible]" brand patent wrought nails steel nails, &c.

Discounts—

42½ per cent. off 1 inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

37½ per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

37½ per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 10/6 per cwt.
4 cwt. lots and upwards 10/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch to 6-inch basis—

2 tons 9/3 per cwt.
4 cwt. lots 9/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £8 per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	6
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	9
C 20 by 14 112s. 108 ,, "Lydbrook"	0	13	3
C 28 by 20 112s. 216 ,, "Lydbrook"	1	6	9
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	14	0

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d.	
Steel:					
Blooms	at	4	6	0	per ton.
Billets	at	4	8	0	,,
Sheet Bar	at	4	10	0	,,
Finished Steel:					
Bars	at	6	0	0	per ton.
Angle	at	6	2	0	,,
Tees	at	6	4	0	,,
Joists	at	5	5	0	,,
Fencing Standards	at	6	7	6	,,
Shoeing Bars	at	6	5	0	,,
Tyre Bars	at	6	5	0	,,
Half-Round Bars	at	6	10	0	,,
Heavy Rails	at	6	0	0	,,
Light Rails	at	6	0	0	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	166	10	0	to	167	0	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	167	10	0	to	168	0	0	,,
Straits G.M.B., cash Warehouse, Net	164	17	6	to	165	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	165	2	6	to	165	5	0	
Australian, Mt Bischoff, Warehouse, Net	165	10	0	to	165	12	6	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	79	17	6	to	80	0	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	79	10	0	to	79	12	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	86	10	0	to	87	0	0	,,
English, Best Select, Warehouse Net	87	0	0	to	87	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	95	0	0	to	95	10	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	90	0	0	to	91	0	0	,,
Electro, Warehouse, Net	88	10	0	to	89	0	0	,,
Ore, ex. ship	0	15	6	to	0	16	6	per unit.
Regulus, Matte and Precipitate, ex ship,	0	16	6	to	0	17	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	7¾	per lb.
Sheathing ,, ,,	0	0	8	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	29	2	6	to	29	5	0	per ton.
Blende of 50 %, Net	8	10	0	to	8	13	6	,,
Calamine, Net	8	12	6	to	8	15	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis 2½%	17	15	0	to	17	17	6	per ton.
Spanish, ex ship, Dis. 2½%	17	5	0	to	17	7	6	,,
Lead Ore of 70 %, Net	9	0	0	to	9	10	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	63	0	0	to	65	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	0	0	to	17	0	0	,,
Crude, ex ship, Dis. 2½ %	32	0	0	to	35	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	5	0	per flask
Italian ,, ,, ,,	7	2	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	6
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston, quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	3
Large Nuts (1½ to 3¼)	9	0
Small Nuts (¾ to 1½)	6	0
Peas (⅜ to ¾)	5	0
Rough Slack	4	0
Slack	3	6
Smudge	2	0

Rutland Coal:		
Brights (4 to 8)	7	6
Large Nuts (2 to 4)	7	0
Slack	3	6
Hand-picked Hards	7	6
Hard Cobbles	6	3

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL (or Ashless House Coal).		
London Brights, 4 to 8 in. cube	11	0
Bright Cobbles (Hand Picked)	10	6
Large Nuts, 2 to 4 in. cube	10	0
Small Nuts, 1 to 2 in. cube	6	3
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb
	Picric, Crystals	0	0	11	,,
	Tartaric at Manchester	0	0	10⅝	,,

		£	s.	d.	
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	15	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	24	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	18	0	,,
Arsenic:	Best White Powdered net	15	5	0	,,
Bleaching Powder,	35% ,,	4	7	6	,,
Borax:	British Refined Crystal ,,	13	0	0	,,
Coal Tar Products:					
	Benzole, 50/90 % ,,	0	0	8½	per gal
	,, 90% ,,	0	0	9	,,
	Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb
	,, ,, ,, 39/40° C. ,,	0	0	6¼	,,
	,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
	,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	10	,,
	Creosote, ordinary good liquid ,,	0	0	1⅝	,,
	Naphtha, Crude, 20 % at 120° C. ,,	0	0	4	,,
	,, Solvent, 90% at 160° C. f.o.b ,,	0	1	0	,,
	,, ,, 95 % at 160° C. ,, ,,	0	1	0½	,,
	,, ,, 90 % at 190° C. ,, ,,	0	1	1½	,,
	,, Rectified, flash point over 73° F. f.o.b. ,,	0	1	1½	,,
	,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	2½	,,
	Naphthalene, all qualities.				
	Pitch f.a.s. Manchester. ,,	1	12	6	per ton.
Copperas:	Green, in bulk ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	18	6	,,
	Cake ,,	1	1	6	,,
Copper:	Sulphate	25	5	0	,,
Cyanides:	98% minimum f.o.b. net	0	0	8½	per lb.
Lead:	Acetate (Sugar) White, English	28	0	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	25	10	0	,,
	,, ,, Grey	23	10	0	,,
	,, ,, Brown at Manchester	19	15	0	,,
	Nitrate	27	0	0	,,
	Litharge, Flake	19	0	0	,,
	,, Powder	19	10	0	,,
	Red Lead, Genuine, c.i.f London less 5%	19	0	0	,,
	White ,, ,, Dry ,, ,, ,,	20	0	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	4	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate... delivered England	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull	16	15	0	per ton.
	Caustic, 75/80 % ,, ,,	18	12	6	,,
	Chlorate net	0	0	3¼	per lb.
	Montreal in Store, Liverpool	31	10	0	per ton.
	Prussiate Yellow net	0	0	4⅔	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined... .. ,,	6	5	0	,,
	,, Carbonated, 48 %... .... ,,	5	10	0	,,
	,, ,, 58 %, (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 %.. .... net	6	10	0	,,
	Caustic, White, 77 %.............. ,,	10	12	6	,,
	,, ,, 70 %.............. ,,	9	12	6	,,
	,, ,, 60 %. .... ,,	8	12	6	,,
	,, Cream, 60 %..... .... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .. .. net	0	0	3¼	per lb
	Nitrate...ex quay Liverpool, ... ,,	11	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	$3\frac{7}{16}$	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)...............	1	10	0	,,
	,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.......................	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1 White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports...	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10½d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	15	6	to	0	16	6	per unit.
Regulus, 45 to 55%	0	16	6	to	0	17	6	,,
Precipitate, 65 to 80% ...	0	16	7½	to	0	17	1½	,,
Tin Ores, 70 %...............	103	0	0	to	105	0	0	per ton.
Lead Ore, 70%					9	13	0	,,
Blende, 50%					8	13	6	,,
Calamine......................					8	16	0	,,
Antimony, Star Regulus	62	0	0	to	63	0	0	,,
,, Ore 50%......	15	0	0	to	17	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	7	8	per ton.
Do.	,,	Cartagena	8	0	,,
Special low phos.	,,	Porman			
Do. do.	,,	Cartagena....... ...	8	2	,,
Extra quality do.	,,	,, ...	8	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	....	11	0	,,
S.P. Campanil Coast	,,	.	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine.............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce..	,,	7	7	6		7	12	6
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s	d		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.............	per load	12	0	0		19	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars............... ..	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	.	11	0	0		16	0	0

SELECTED PATENTS.

NEW PATENTS APPLIED FOR.

ENGINEERING—CIVIL, MECHANICAL, ETC.

26,933. C. H. **Brown** and C. **Parker**, Birmingham.—Improvements in automatic lathes.

26,934. H. **Bedford**, Stockton-on-Tees.—Improved fire-brick cylinder or chamber for burning liquid fuel in steam generators.

26,939. G. W. **Patlersen**, Bowess.—Perpetual power.

26,940. J. **Howarth**, Halifax.—Improvements in loose pulleys.

26,945. R. **Lucas**, London.—Improvements in automatic lubricators.

26,950. L. **Wilson**, Greenock.—Improvements in gas turbines.

26,952. J. **Gardner**, Manchester.—Improvements in telegraphy and signalling by means of sound.

26,959. A. **Macdonald**, Glasgow.—Improvements in and relating to machines for cutting gear teeth in wheels, keyways in shafting and the like.

26,970. A. **Macdonald**, Birmingham.—A new or improved apparatus for enabling the pressure of internal combustion engines to be utilised for sounding automobile horns and the like.

26,974. L. C. **Woerner**, Glasgow.—An improved limit gauge with interchangeable measuring cheeks.

26,982. J. C. **Sellars**, Birkenhead.—Improvements in conduits for the disposition of air or other gases for aeration, ventilation or other purposes.

26,986. R. **Jones**, London.—Improvements in and connected with tip waggons.

26,990. P. L. **Weston**, London.—Improvements in bevel gear milling machines.

26,992. W. R. **McKeen**, jun., London.—Improvements in truss frame for cars.

26,993. W. **Hoettger**, London.—Improvements relating to the preservation of wood.

26,997. N. **Chandler**, London.—Improvements in means for preventing leakage of fluids suitable for use in connection with centrifugal pumps fans and the like.

26,998. F. **Clarke**, London.—Improvements in condensing apparatus suitable for use in the purification of coal and other gases.

27,000. F. O. **Bynoe**, London.—An improved rotary engine, pump, air compressor, and the like.

27,001. W. **Hill**, London.—An improvement relating to coke ovens.

27,005. H. **Millholland** and **The Darling Pump and Manufacturing Company Ltd.**, London.—Improvements in valves.

[illegible]. O. [illegible], London.—Improvements in steam shovels.

27,018. A. **Trevithick**, London.—Improvements in or applicable to boilers of the locomotive type.

27,024. C. J. A. **Grille**, London.—Improvements in steam generators.

27,025. H. K. **Thaugland**, London.—Cutter for planers.

27,028. B. A. **Slade**, London.—Improvements in or relating to rotary engines and pumps.

27,029. C. A. F. **Ranström**, London. Improvements in liners for centrifugal liquid separators.

27,037. A. **Petrie** and E. **Tourret**, Dunkirk, France,—Automatic lubricator.

27,039. B. L. **Samuel**, Glasgow.—Improvements in drawing instruments.

27,055. W. E. **Barker** and W, **Barker**, Sheffield.—Improvements in or relating to steam boïlers.

27,058. J. E. **Graham**, Glasgow.—Disconnecting gear for engines and for other purposes.

27,062. T. C. **Fidler**, Dundee. Improvements in surface condensers.

27,067. W. **Mitchell**, London.—Improvements in steam generators.

27,087. O. **Richter**, London. Improvements in elastic fluid turbines.

27,093. R. **Armengaud**, H. **Clerc**, and C. **Lemale**, London.—Improvements in or relating to rotary fans, compressors or pumps for air or other elastic fluid.

27,106. H. **Gray**, London.—Improvements in appliances for indicating and registering the speed of engines, machines and vehicles, also stoppage and (or) reversal of motion, together with the period and time of occurrence.

27,116. W. **Mycock**, Manchester.—Improvements in steam turbines.

27,133. L. C. **Cary**, London.—Improvements in automatic train-pipe couplings.

27,141. W. **Fairweather**, London.—Time recorder (F. B. Lathrop, United States).

27,150. I. R. **Hasley**, London.—Improvements in railway ties or sleepers.

27,162. W. P. **Thompson**, Liverpool.—An improved method of utilising steam.

27,165. H. W. **Taylor**, London.—Improvements in trussed concrete or like constructions.

27,168. J. **Chapman**, London.—Improvements in and relating to pullies.

27,175. F. O. **De Hymel**, **Frederick** C. L. **Polk** and M. M. **Neal**, London. Pumping machines.

27,184. F. J. **Cox**, London.—Improvements in or relating to gas producing apparatus.

27,188. G. **Fouillaron**, London. Improvements in and relating to expanding pulleys for change speed mechanism.

[illegible]. J. S. **Webb**, London.—Combined rail joint and chair.

[illegible]. J. C. **Cott**, London.—Improvements in tire-fastening devices.

[illegible]. R. M. [illegible] and A. Hendry, London.—Improvements in machinery driving belts.

27,[illegible]. W. Thomson, Glasgow.—Improved interlocking device for use in connection with centrifugal machines.

27,232. W. Nuttall and J. S. Lomax, Manchester. Improvements in or relating to steam drying cylinders.

27,237. E. J. Stevenson, London.—Improvements in or connected with means for obtaining motion in one direction by the compression or exhaustion or movement of a fluid in either direction more especially applicable to railway brakes.

27,240. S. Cutler, London.—Improvements in spiral guided gas-holders.

27,254. F. W. **Klever**, London.—Improvements in and relating to the manufacture of lubricating and anti-corrosive oils.

27,255. A. **Holtz**, London.—Improvements in or relating to transmission mechanism.

27,258. D. **Morehouse**, London.—Improvements in lubricators.

27,272. G. **Gadda**, London.—Improvements in gas turbines.

27,283. G. **Johnston**, London.—Improvements in valves.

27,284. J. G. **Krugen**, London.—Improvements in and relating to motors.

27,285. W. A. **Richards** and C. B. **Redrup**, London.—Improvements in and relating to rotary engines.

ELECTRICAL.

27,197. The British Thomson-Houston Company, Ltd., and F. W. Carter, London.—Improvements in and relating to electric traction systems.

27,198. Allgemeine Elektricitats-Gesellschaft, London.—Improvements in and relating to dynamo-electric machines.

27,224. J. H. **Sutton**, and L. **Gregson**, London.—Improvements in electric conduits.

27,241. H. H. **Berry**, Enfield.—Protected or armour-clad combined electric switchfuse plugs.

27,251. P. Muller, London.—Improvements in continuous current arc lamps, particularly applicable to search lights, projection lamps and the like.

27,260. V. A. **Fynn**, London.—Improvements in alternate current commutator motors and generators.

27,271. J. M. **Moffat**, R. J. **Bott**, J. W. **Manley**, and The Electric Safety Appliances Company, Ltd., London.—A new or improved method of winding the coils of electrical measuring or indicating apparatus and the application thereof to instruments for detecting and obviating leakage from conductors of electricity.

27,[illegible]2. A. G. **Bloxam**, London.—Improved manufacture of electric incandescence lamp filaments from tungsten or molybdenum or an alloy thereof.

27,[illegible]. W. P. Thompson, London.—Double armature dynamo or electric motor and transformer.

27,057. M. B. **Mountain** and G. M. **Gibson**, Manchester.—Improvements in swivelling contacts for the trolley standards of electric tramcars and the like.

27,[illegible]. The British Thomson-Houston Company, Ltd., London.—Improvements in electric motor control systems and in apparatus therefor. (The General Electric Company, United States.

27,[illegible]. E. W. Hart and W. P. [illegible], London.—Improvements in electric propulsion of railway, tramway, road or similar vehicles, boat and the like.

27,[illegible]. W. R. [illegible], London. [illegible] Improvements in electrical switches.

27,14[illegible]. W. L. [illegible], London.—Improvements in dynamo electric machinery.

27,[illegible]. F. Porsche and L. Lohner, London.—Improvements in or relating to cores of electro-[illegible] machine.

27,[illegible]. G. Danville, London.—Improvements relating to electric accumulators.

27,[illegible]. C. C. Garrard and Ferranti, Ltd., London.—Improvements in and relating to electrical measuring instruments.

27,[illegible]. C. Smart, London.—Improvements in automatic suspension gear, [illegible] coupling [illegible] the arc lamps and the like.

SHIPBUILDING, ETC.

27,[illegible]. W. E. Wynne, J. Barrett, and C. [illegible], London.—A new or improved brake for the steering wheels of ships and other wheels.

27,044. F. Phillips and G. Phillips, [illegible]smith.—Marine propeller.

27,[illegible]. D. Cook, London.—Improvements in torpedoes.

27,[illegible]. R. Schubert and A. Barth, London.—Improvements in screw-propellers.

27,[illegible]. H. S. Searle, London.—Improvements in propellers for boats.

27,230. G. F. **Villinger**, London.—Improvements in reversible propellers.

27,247. G. **Roy**, London.—Improvements in or relating to motor installations for boats.

MINING.

27,[illegible]. W. Clifford, London.—Mechanism for ventilating mines and the like.

27,[illegible]. R. Stanley, London.—Improvements in or connected with coal heading machines.

IRON AND STEEL—METALLURGICAL.

27,[illegible]80. T. J. **Heskett**, London.—Improved process of and apparatus for obtaining metals from their sulphides.

27,[illegible]. C. T. Hyde, London.—Improvements in guide blocks for the stems of the stamps of stamp-mills.

27,[illegible]7. **Davy Bros., Ltd.**, T. **Edmund Holmes**, and E. **Crowe**, London.—Improvements in controlling gear for reversing rolling mill engines.

27,014. J. **Rice** and J. **Johns**, Liverpool. Improvements in or relating to pyrites burners or kilns.

27,[illegible]. L. A. [illegible], London.—Improvements in brazing and in fluxes employed therein.

27,[illegible]. D. Cook, London.—Improvements in metallurgical processes.

27,080. W. R. **McKay**, London.—Certain improvements in crushers and pulverizers.

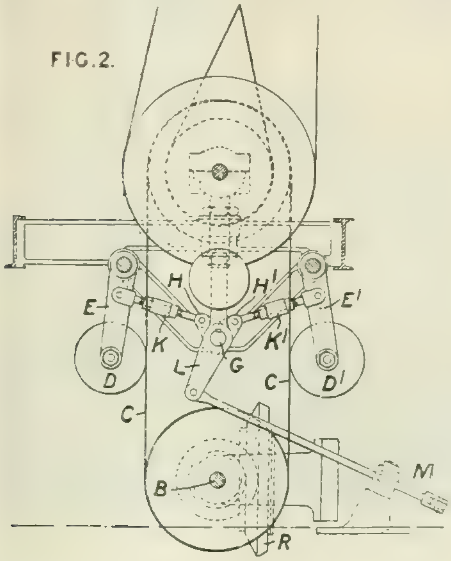
27,[illegible]. J. Fraser, Manchester.—Improved metallurgical process.

27,[illegible]. A. H. [illegible], Liverpool.—Improvements relating to the hardening of cast iron and the like.

ABRIDGED SPECIFICATIONS.

W. C. Mitchell, Brooklands, Cheshire.—19,683.—By this patent a reversing motion in planing-machines and other machine tools is obtained by running two belts in opposite directions loose upon their pulleys and alternately tightening them by means of jockey pulleys. The jockey pulleys D, D¹ are suspended in swinging frames E, E¹ and are operated from a shaft G by levers H. H¹, through links K, K¹. The shaft G is rocked by levers L, M, operated by the reciprocations of the machine and carries a weighted lever to assist in the action. The levers H, H¹, are such that, when one of the jockey pulleys tightens its belt C, the other recedes and lets its belt run loose. To prevent heavy strains at reversal and when taking heavy cuts, the bevel-wheel R, driven from the shaft B, drives its shaft through friction gearing which will slip when the load becomes excessive.

FIG. 2.



H. Lentz, 11, Potsdamerstrasse, Berlin, and C. Bellens, 64, Rue de St. Petersbourg, Paris.—19,229.—Relates to the application of cylindrical lift distributing valves to locomotives, in order to facilitate the use of super-heated steam. The ordinary cylinders are removed and replaced by cylinders *a*, fig. 1, fitted with the special arrangements of distributing valves, which are adapted to be operate by the ordinary valve gear. Fig. 3 shows a longitudinal section through a cylinder and valve-chest, and fig. 8 a section through a valve-chest cover forming a dustproof and oiltight casing for the means of operating the valves from the ordinary valve gear. This casing comprises a longitudinal passage *k* containing the rod *o*, which is connected to and operated by the rod *b* and vertical tubes, *m*, m^1, m^2, m^3. In order to prevent irregular expansion of the walls of the cylinder, the steam passage *g* and exhaust passage are isolated from the cylinder. A modification is shown in fig. 6 applied to compound cylinders arranged in tandem. The valve-chest cover may be divided into two parts at the centre. The present specification describes also means for [illegible] radial valve gears from being effected by [illegible] arising from the yielding suspension of the [illegible] wheels. These means appear to consist in the use of a bar forming a rigid connection between the axle and the adjustable rocking shaft for regulating or reversing the engine.

FIG. 1.

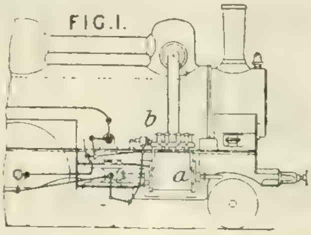


FIG. 3.

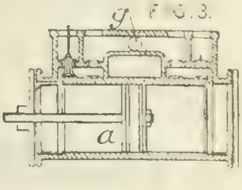


FIG. 8

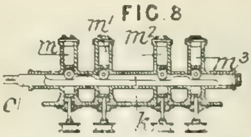
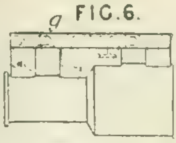
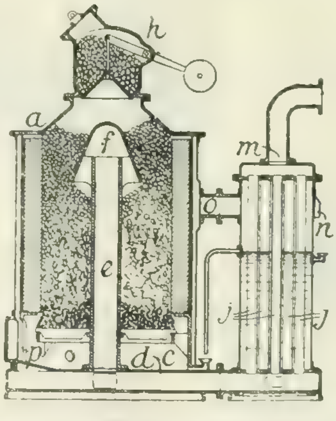


FIG. 6.



D. Roberts and H. C. Anstey, Spittlegate, Iron Works, Grantham, Lincolnshire.—[illegible]—Relates to gas producers.—The gas from a gas-producer is drawn off from a vertical pipe or pipes passing through the fuel and is applicable for use with a gas engine when it is preferable to work the producer by suction and to use bituminous coal. Fuel is admitted by the feed-hopper *h* and the gas generated escapes under the hood *f*, down the pipe *e*, along the box *d*, and into a steam generator comprising a cylinder partly filled with water, finally leaving by the pipe *n*. The air supply is forced or drawn through the inlet *o*, mixes with steam produced by the passage of the hot producer gas through the pipes *j*, and passes through the connecting pipe *p* to the jacket surrounding the generator body *a*, finally escaping through the opening [illegible] into the ashpit and thence into the fuel.



NEW PUBLICATIONS.

"WHO'S WHO, 1906."

Adam and Charles Black. 7s 6d. net.

It is impossible to over estimate the value of this indispensable reference book, which, year by year, has increased in usefulness until now, it is without doubt the best work of its class. Elaborate care has been expended upon the compilation of "Who's Who," and one has a sense of security in consulting it, for in each case the biographical particulars have been submitted to the subject's revision. From the same publishers we have received the companion "Year Book" the tables of which were the original nucleus of the above mentioned annual. Among other useful details are lists of university professors, steamship lines and their agents, societies and their secretaries.

"THE SCIENCE YEAR BOOK, 1906."

King, Sell and Olding, Ltd. 5s. net.

This publication, comprising a diary, directory and scientific summary, has reached its second year of publication, and seems likely to fill a useful niche in the scientific world. Without opening the cover one perceives that the interior must of necessity be up-to-date for there is a fascinating arrangement by which the calendar for each month is seen through an aperture in the front board. One cannot say quite as much for the scientific summaries, which illustrate the difficulty of dealing comprehensively in a few pages with the advances made in electro-technics, chemistry, and other great subjects. They are, however, in good hands, Professor J. D. Cormack, B.Sc., A.M.Inst.C.E., being responsible for the engineering section, while Professor W. E. Ayrton, F.R.S., presents some interesting facts about electric lighting, power distribution and kindred subjects. The frontispiece is a fine portrait of Sir Wm. Huggins, K.C.B., D.C.L., LL.D. Among other features we note that new maps of the constellations and of the Moon replace the old ones. Maps of Magnetic Variation and Rainfall are added, as are tables of Geology and of the Animal Kingdom. In addition to many new notes, among those on Physics and Chemistry is a table of Spectra. In the directory, a list of universities with professors of science is included, also a list of Colonial Scientific Societies, and many new names are added to the biographies. A list of books published during the year is another new feature. We think the Science Year Book should have a healthy future. The diary space measuring 5 in. by 6 in. for each day is quite large enough for the average scientist, business man or engineer. The idea of binding up a personal diary with a record of current progress seems an excellent one.

BOOKS RECEIVED.

"The Design of Structures." A practical treatise on the building of bridges, roofs, etc. By S. Anglin. Fourth Edition revised. Charles Griffin and Co., Ltd. 16s.

"The Practical Telephone Handbook." By Joseph Poole, A.I.E.E. Third Edition. Whittaker and Co. [illegible] net.

"Wireless Telegraphy and Telephony." By Professor Domenico Mazzotto. Translated from the Original Italian by S. R. Bottone. Library of Arts, Sciences, and Industries. [illegible] by [illegible] pp. Whittaker. [illegible] net.

"Hydraulic Tables. Showing the loss of head due to the friction of water flowing in pipes, aqueducts, sewers, etc., and the discharge over weirs." By Gardner S. Williams, A.M.S.C.E., and Allen Hazen, M.Am.S.C.E. John Wiley and Sons, New York. Chapman and Hall, London.

NEW CATALOGUES.

Neville Bros., 7 and 9, James Street, Liverpool. — A handy catalogue of labour-saving machines and tools, includes vacuum-drying and impregnating chambers for dynamo and motor armatures, coil-covered wire, etc., automatic coil-winding machines, slot broaching and slitting machines for assembled stator and rotor stampings of induction motors, and many other appliances interesting to the manufacturers of electrical machinery. Other tools and appliances illustrated include a wide range of high speed drills an automatic keyway cutting, milling and drilling machine, portable workshop cranes, improved Rufford flexible safety couplings, regenerative gas muffle furnaces, rapid coke fired rivet heaters, etc., etc. This is a useful catalogue to keep on file.

Carrick and Ritchie, Edinburgh, have issued a new and freely-illustrated catalogue of turbines, Pelton wheels, and other motors for the utilisation of water power. In order to suit the extreme ranges of fall, two distinct types of turbines are manufactured: first, the "Waverley," a pressure turbine of the mixed-flow class, suited for low and medium falls up to 80 ft., and, by a special method of construction, adapted to falls up to 200 ft.; secondly, the "Girard," an impulse turbine of the partial-injection class, peculiarly suited for high falls, and for running at a moderate speed, and where there are extreme variations in the water supply. Jet water wheels of the Pelton type, suitable for extremely high falls are also described. The "Waverley" turbine is constructed in no less than five different forms. This catalogue has a quantity of tabular matter and useful information. The Girard system is recommended for heads over 50 ft., especially when a moderate speed is required, this being attained by using a wheel of larger diameter in proportion to the power developed than with the "Waverley" turbine. Girard turbines are made with horizontal shafts, so that the power may be transmitted by belts or ropes, or should the speed be suitable they may be coupled direct to a line of shafting, or to an electric generator. Although only listed for falls up to 400 ft., they are quite suitable for falls up to 800 ft., and in various parts of Scotland, Ireland and Wales turbines are at work under 250, 350, 600 and 800 ft. head. The water is admitted to the inner circumference of the wheel, and is discharged outwards. The position of the inlet ports in relation to the buckets is such that the water is discharged at the lower side of the wheel, and passes away through an opening in the bed-plate. The turbine, being worked by the impulse of the water only, must be fixed up so as to be above the level of the tail-water, and as no suction pipe can be used, it should be set as low as possible, allowance being made, of course, for any rise of the tail-water during floods. The water is admitted to a portion of the circumference of the wheel only, the number of the ports being determined by the diameter and capacity of the wheel. The admission of the water to the ports is regulated by a gun-metal slide, opening or closing the ports one after the other. By this arrangement a high efficiency is obtained when a diminished supply of water is used. The slide may be worked by hand, and also by a governor. The latter is usually combined with a hydraulic cylinder for operating the slide.

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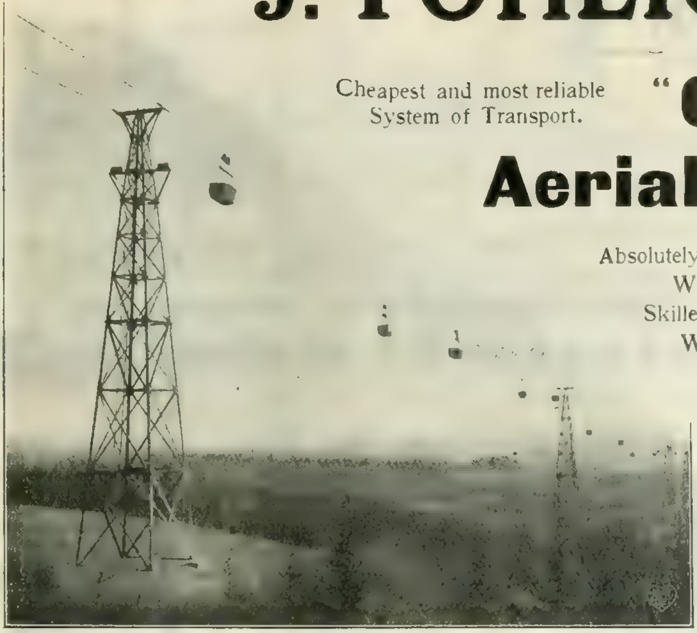

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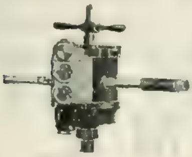

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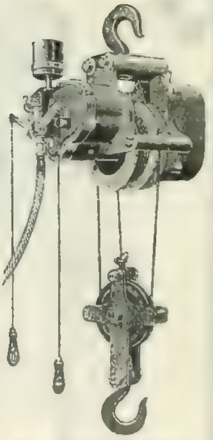

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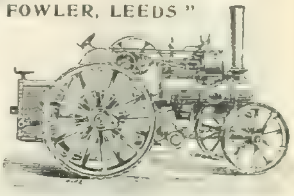

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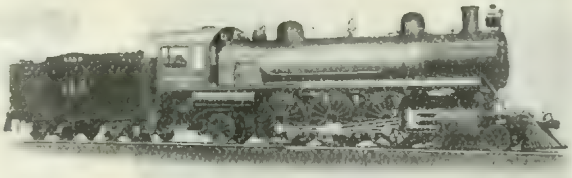

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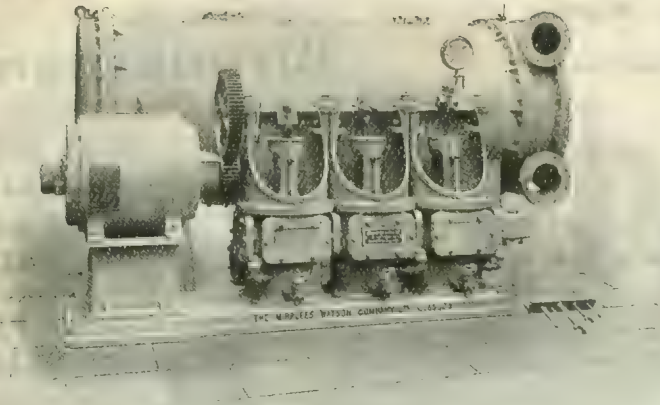

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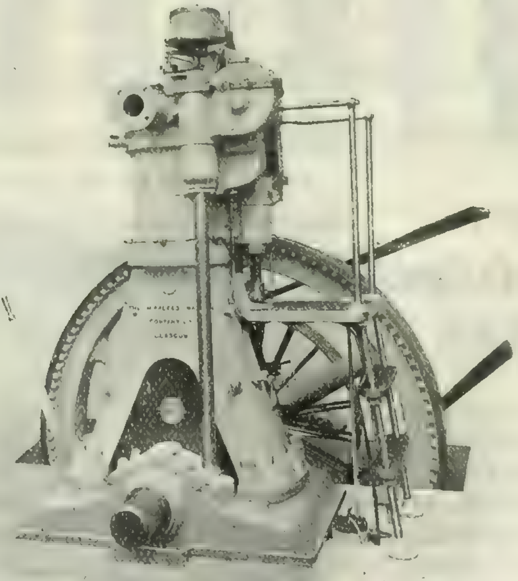

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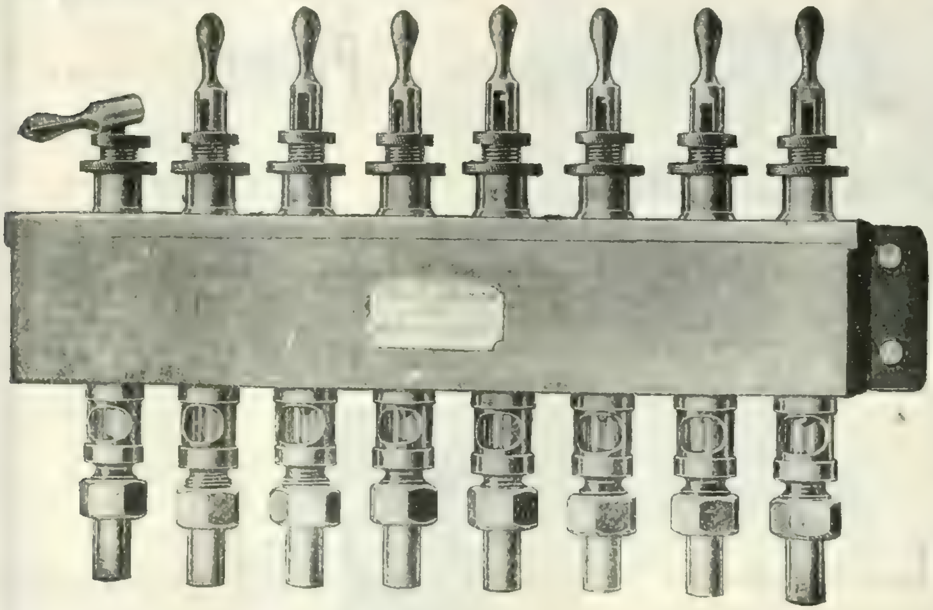

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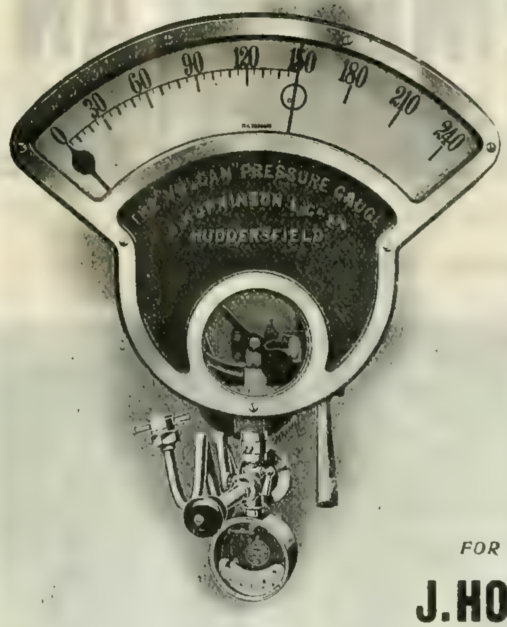

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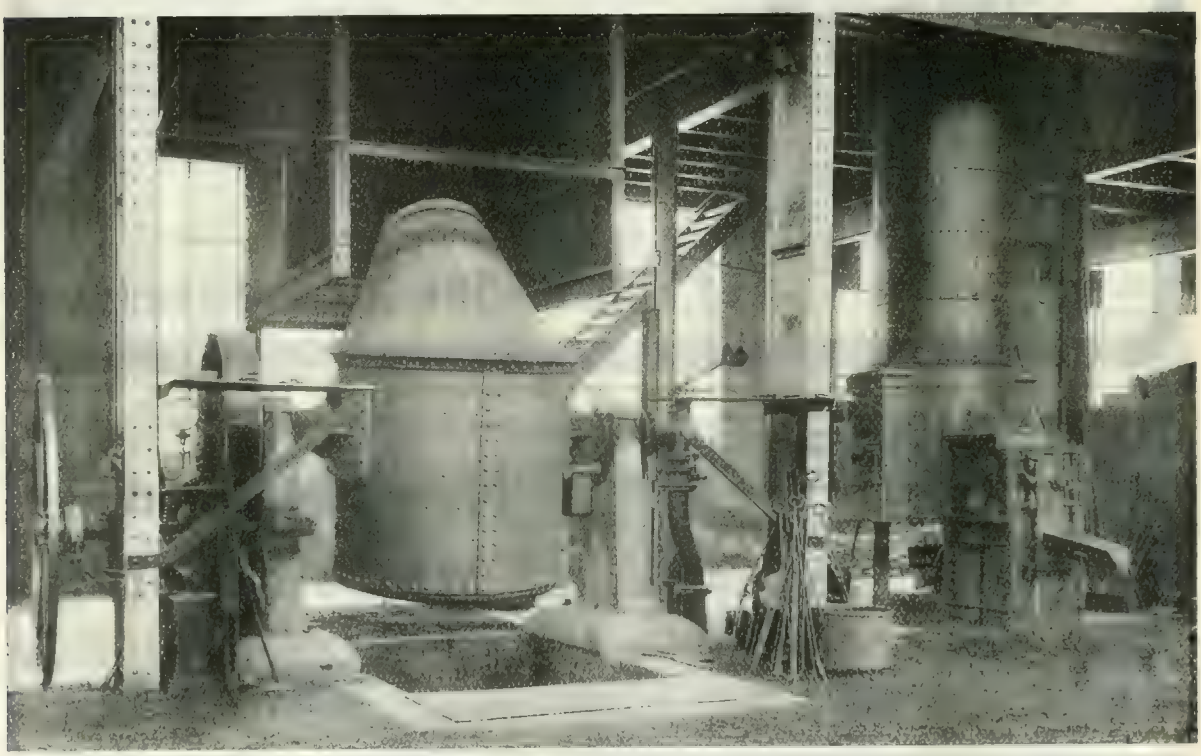

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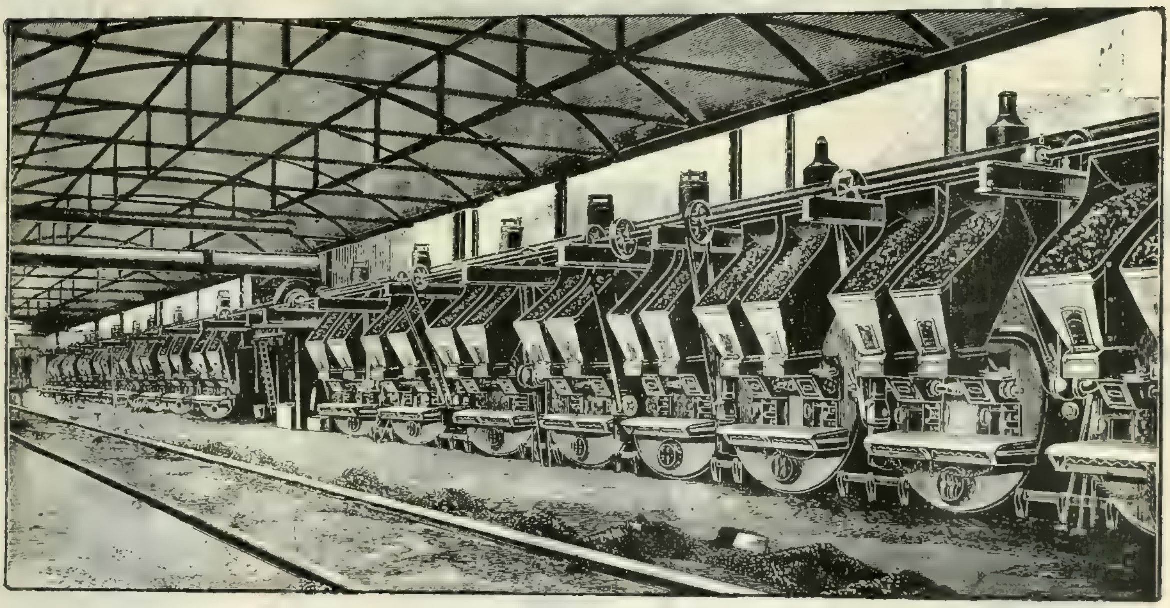

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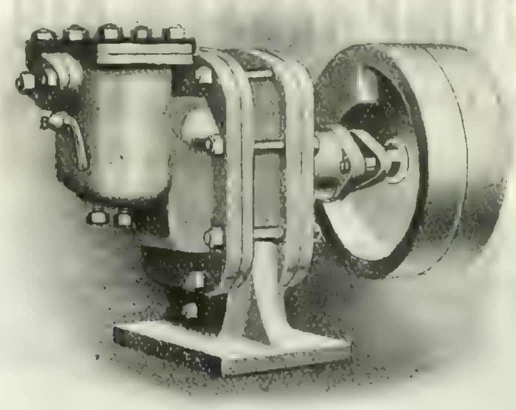

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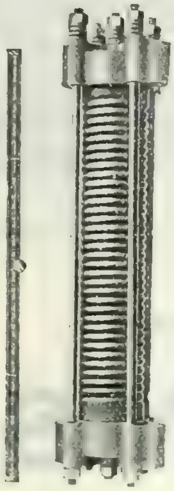

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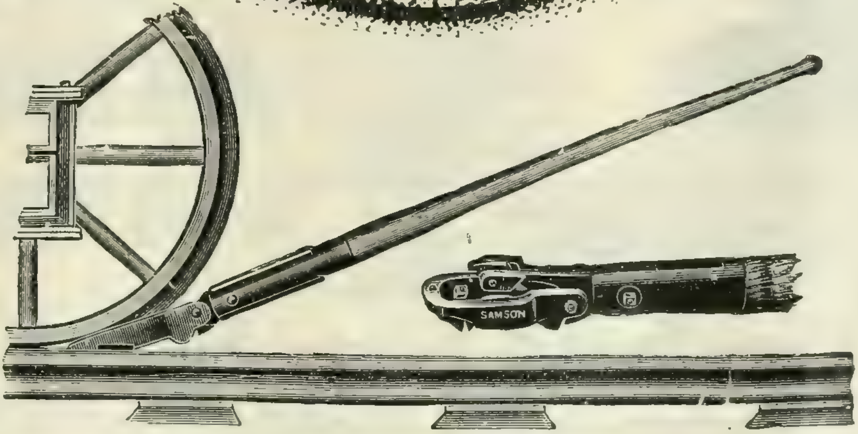

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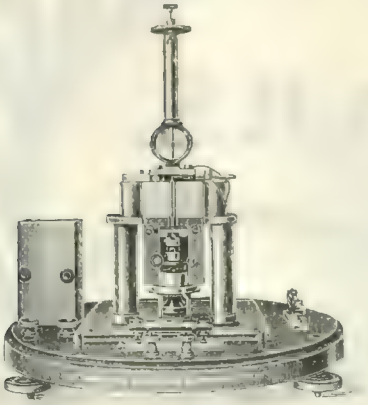

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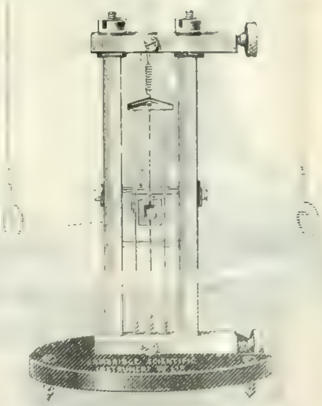

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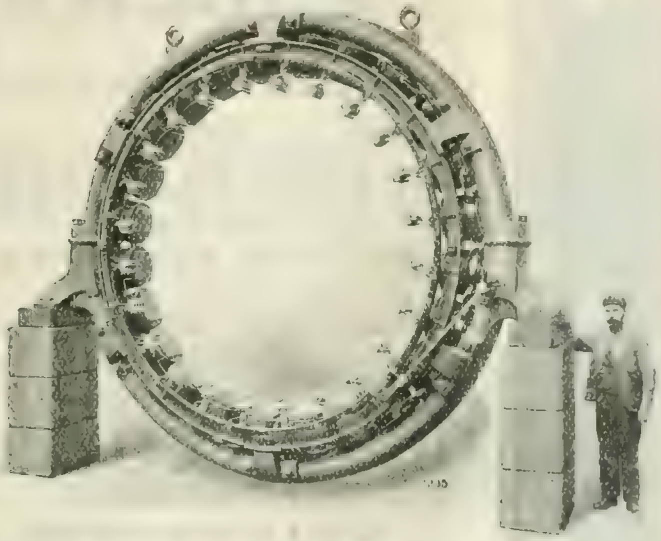

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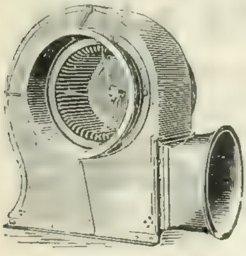

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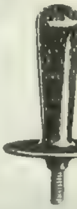

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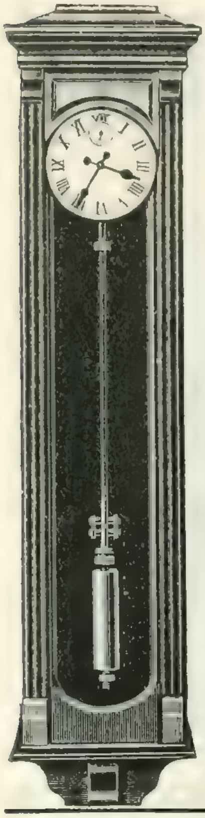

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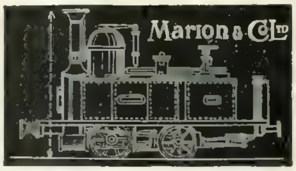

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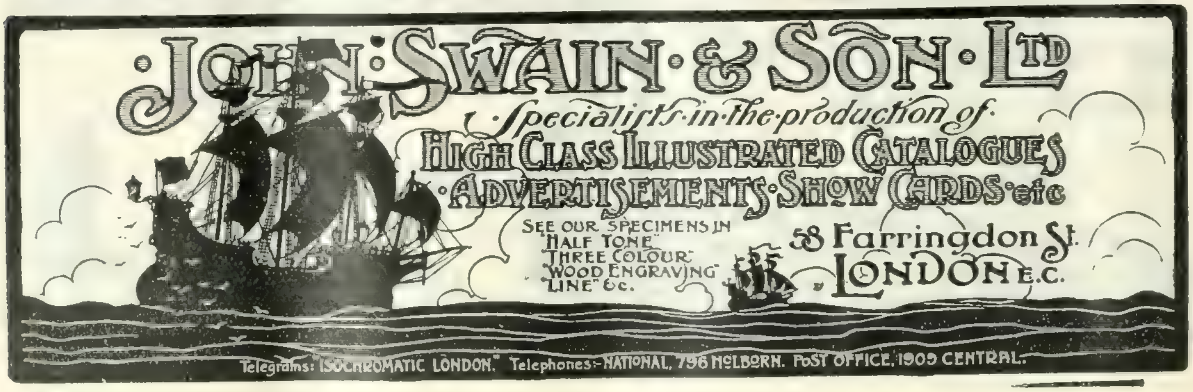

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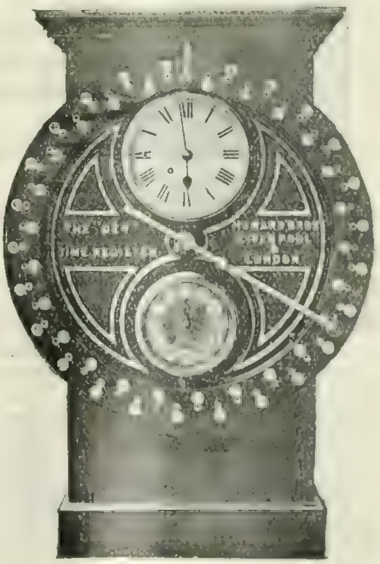

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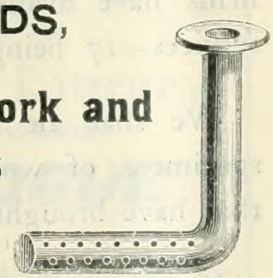

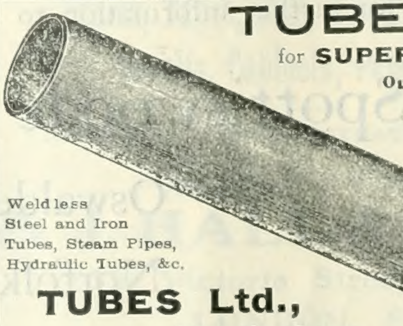

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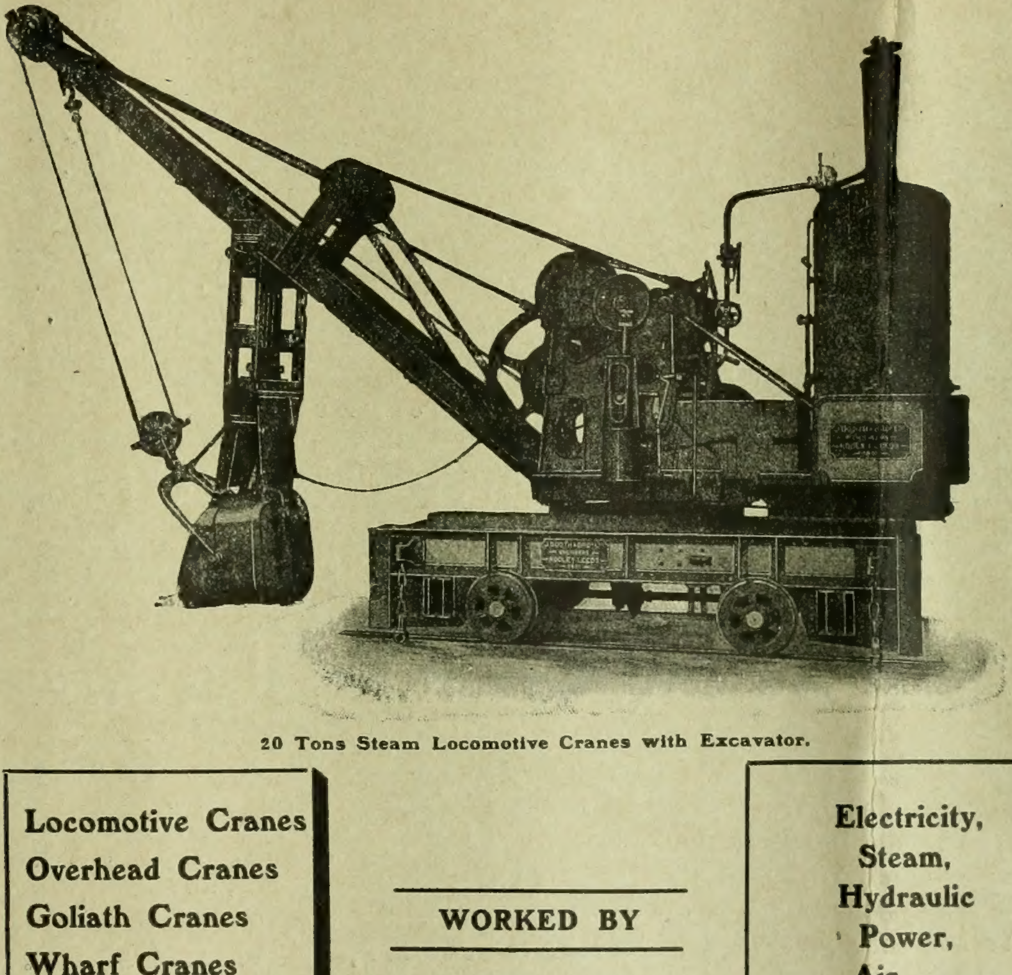

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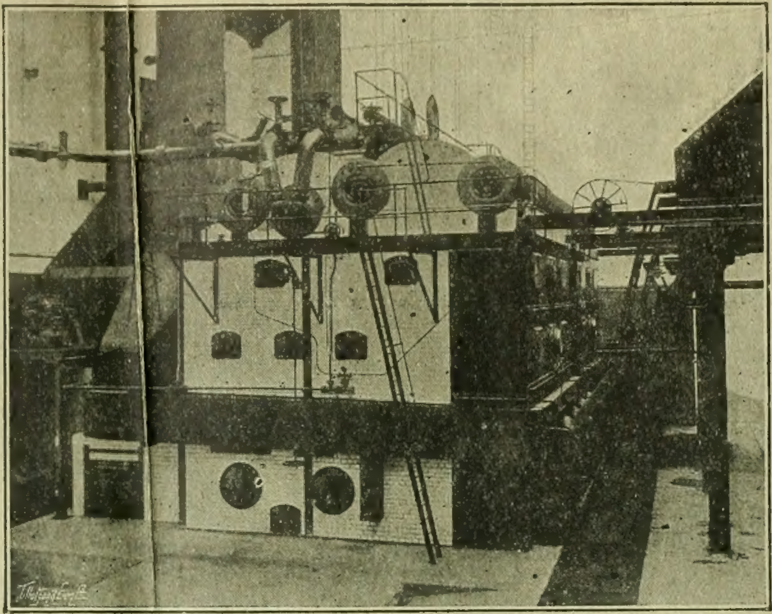

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